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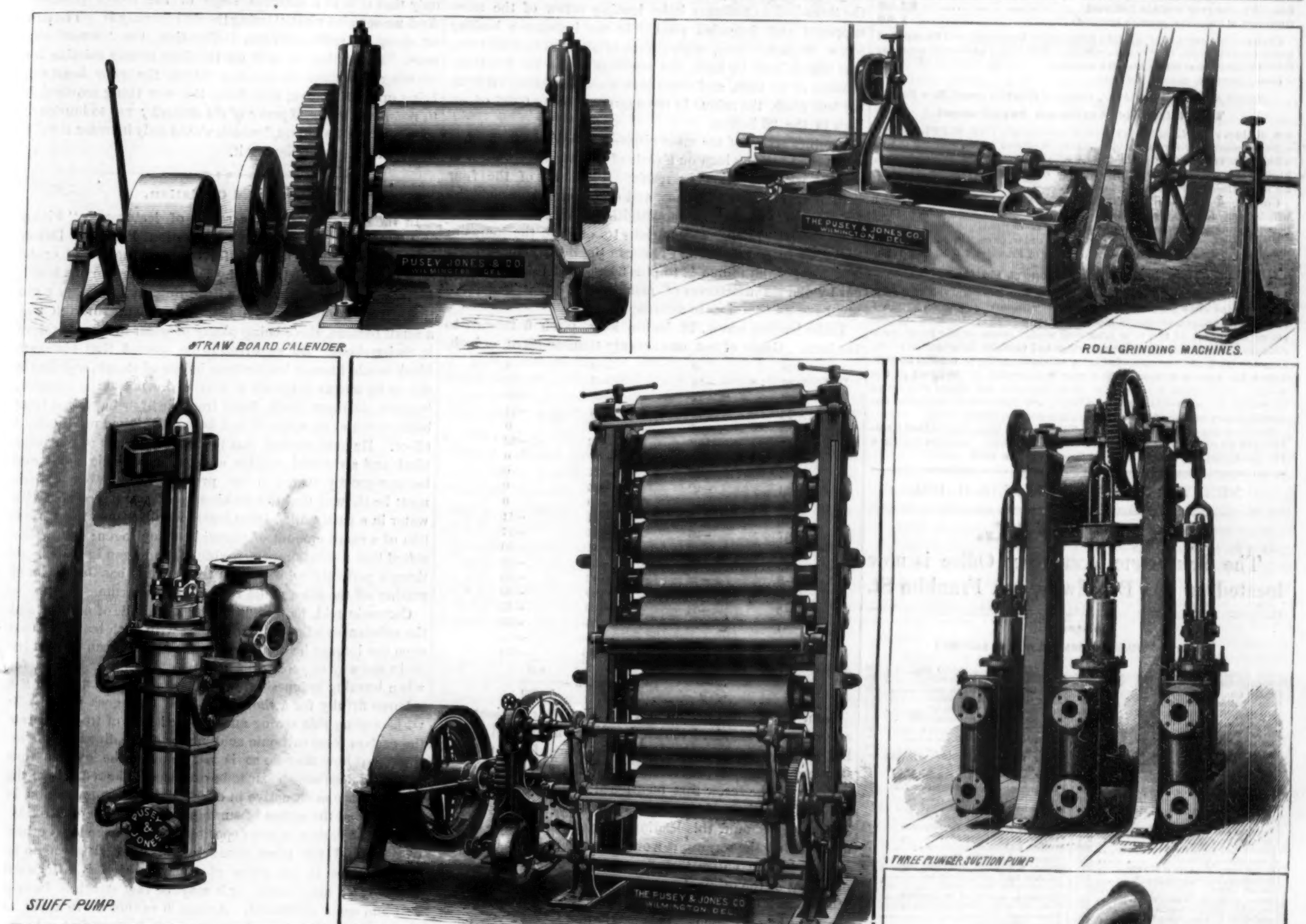

PAPER MAKING MACHINERY OF THE PUSEY & JONES COMPANY, WILMINGTON, DEL.—[See page 386.]

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 442,

For the Week ending June 21, 1884.

Price 10 cents. For sale by all newsdealers

CURIOSITIES OF SCREW CUTTING.

The exact tests in measurements which are now made from precise standards of dimensions in machinists' work reveal some rather humiliating facts to those who have heretofore claimed to build "tools of precision." Standards of diameters and lengths have been acknowledged as difficult to attain to in ordinary work; but it was supposed that screws, particularly the leading screws of lathes, could not vary much in pitch of thread from an established standard. But with tests made by lined hardened steel bars, aided by the microscope, it is proved that the best of screws, as ordinarily produced, are defective. So great have been ascertained to be these defects that a half nut, only three inches long, correctly cut by the aid of the microscope, would ride the thread of an ordinary lathe leading screw of the same supposed and intended pitch. In one instance a leading screw, 36 inches long, with a pitch of six threads to the inch, was tested, inch by inch, the readings being by five-thousandths of an inch, and every inch showed a falling off from the true pitch, the minus in the aggregate being 0·027 of an inch in the 36 inches.

Another screw of the same pitch—6 threads to the inch—was tested inch by inch on a scale of seventy-thousandths of an inch with the following result: Each one of the four columns represents 18 inches, and each figure represents the fraction of one seventy-thousandth of an inch variation from the true pitch. It is curious to observe the jumps in variation in some places. Thus, in the third column there is a jump from minus 42 to plus 369. And this screw was cut by the manufacturers of machine tools that indisputably have no superiors in accuracy.

Lathe leading screw, 72 inches long, pitch 6 threads to the inch. Grade of test, one seventy-thousandth of an inch.

−28	0	−29	−4
−19	−16	−7	−14
−26	−12	+10	−12
−16	+19	+23	−14
−33	−8	−6	0
−15	−8	−12	−32
−12	−14	−17	0
−15	−17	−21	0
−24	−22	−34	0
−33	−9	−40	0
−18	−3	−31	−11
−17	−25	−43	−17
+8	−19	−46	−20
−13	−18	−37	−53
−8	−28	−42	−32
−8	−18	+369	−33
−5	−11	+25	−37
−27	−58	−14	−58
−309	−267	+48	−315

Total variation $-\frac{843}{70,000}$

Some thoughtless person may say that the exactions of a microscopical standard to this degree are finical and useless. But let one consider that these variations from the true standard not only repeat themselves, but are cumulative. In the case of the screw first mentioned, there was a minus of the grade or pitch of the thread of 0·027 of an inch in only 36 inches. Should this leading lathe screw be used to produce other lathe screws, it would require only six reproductions to lose an entire thread, even if the rate of loss was only that of the original screw. But, ascertaining and demonstrating these imperfections is of little account unless they can be prevented. This can be done, and leading lathe screws, screws for elevating planer crossheads, and for other exact purposes can be made so as to be absolutely "tools of precision."

CHEWING THE CUD.

Every child living in the country has stood and watched this curious operation, and wondered what the lump was which he saw come up in the cow's throat, and then go down again after she had chewed it for a certain length of time. And perhaps he may have seen the anxiety and turmoil produced on a farm by the report that some one of the cows had "lost her cud," and as the result of this excitement he may have seen the absurd attempt to "make a new cud," in the hope that the cow would by such means be restored to good condition. There is in the minds of a large proportion of the readers of the SCIENTIFIC AMERICAN (which simply means the community) so little correct understanding of the true nature of "chewing the cud," that a few words concerning it may not be amiss.

A very large tribe of animals, of which sheep and cows are only familiar examples, are called in works of natural history *Ruminantia* because they all *ruminate*, they chew the cud. They do so because their peculiar organs of digestion require it; they can get their nourishment in no other way. They have, it is said in the books, four stomachs, but the statement is not strictly correct, for the entire digestion is done in a single one, that which is called the fourth, the other three being only places for preparatory work. Their food is swallowed without being chewed; the chewing is to come later. When this unchewed food is swallowed it passes directly into the first stomach, to use the common term; but the drink which the animal takes goes straight past the entrance of the first into the second. These two serve only to *soak* and soften the coarse food. When the first has done what it can, the food passes out of it into the second, and then the cow or sheep is ready to "chew the cud."

The second stomach, while busily at work in soaking the food, keeps it in motion, and gradually rolls it up into masses, so that in the small upper part there is formed an oblong solid lump of the size that we recognize as the "cud." This the animal throws up into the mouth, and chews with evidently as much satisfaction as the same act of mastication gives us when we put the most delicate morsels between our teeth. When it is sufficiently chewed, the mass is swallowed and its place taken by another which had been rolled up in the mean time.

But the "cud" thus masticated does not return to the second stomach, from which it had come. It passes smoothly into the third, a place for additional lubrication, and then into the fourth, where the true digestion begins and ends.

This is, in brief, the whole story, and we see how naturally the chewing comes in; it is the same as in our own case, only that it is at a different stage of the food's progress. And we see also what "losing the cud" really is. The cow or sheep is suffering from indigestion; the "second stomach" has failed to roll up the little masses suitable for chewing, and there is nothing which the poor beast can bring up. Of course, therefore, the one thing required is to *restore the tone and power of the stomach*; not to burden it with an "artificial cud," which would only increase the difficulty, instead of relieving it.

Flame and Oxidation.

In the course of one of a series of lectures on "Flame and Oxidation" at the Royal Institution, Professor Dewar recently exhibited a machine for the manufacture of ozone on a large scale, constructed by Dr. Wise for use in a health resort under his charge in the Engadine. It had thirty-eight tinfoil plates, and the machine to drive the air through was a small turbine, there being plenty of water to drive turbines in Switzerland. By experiment he proved that platinum black would liberate iodine from iodide of starch, and that it did so by means of the air it carried down into the solution, because platinum black, freed from air by being taken from beneath water in which it had been boiled, had not the same effect. He next showed that the mere presence of platinum black and air would oxidize alcohol into acetic acid, and became greatly heated in the process. In another experiment he showed that the shaking up of granulated zinc with water in a partly filled large bottle would cause the formation of a small amount of peroxide of hydrogen; he further stated that a solution of peroxide of hydrogen in water, although perfectly colorless and transparent, has the power of cutting off the ultra violet rays of the spectrum.

Carbonic acid, he said, is the highest oxide of carbon, and the substances adhere to each other with such tenacity, that even the intense heat of burning magnesium can do but little in the way of separating the oxygen from the carbon, for when burning magnesium is plunged into carbonic acid gas it burns fitfully for a short time, and then goes out. Notwithstanding this strong affinity, the leaves of trees separate the carbon from carbonic acid under the influence of sunshine, but how they do so is not known; the oxygen thus separated does not appear to be ozonized. The red rays of the spectrum are most active in effecting the decomposition in the leaf, and the action of sunlight is clearly one of deoxidation. The carbon is not deposited in its pure state, otherwise it could not move about in the plant; it seems to be produced first in the form of sugar, which is afterward transformed into starch; or it may be that starch is formed first and sugar afterward. As starch cannot move about in the plant, the inference is that sugar is formed first. In another experiment he showed that permanganate of potash—Condy's fluid—is deoxidized by the addition of peroxide of hydrogen, although both substances have strong oxidizing powers.

How Clothes Pins are Made.

A dealer thus describes the manufacture of clothes pins to a reporter: "They whittle 'em out at the rate of eighty a minute. A beech or maple log, a foot in diameter and ten feet long, will whittle up into 12,000 clothes pins. That log won't cost more than $3. The clothes pins they cut out of it will be worth $96.40. It will take them two hours and a half to run that log into clothes pins, which is whittling out 4,800 an hour. At ten hours a day they get away with four logs and have on hand 48,000 clothes pins worth $385.60. Now, the lumber for these pins has only cost $8 or so. But then those logs must be sawed up by four different kinds of saws. One separates the log into lengths of sixteen inches; another saws these into boards three-quarters of an inch thick; another cuts the boards into strips three-quarters of an inch square. These strips are caught on a wheel that burries them to a gang of saws which chop them into clothes pin lengths. These lengths are carried by a swift moving belt to a machine that seizes them, sets them in a lathe that gives them their shape in the twinkling of an eye, and throws them to an attendant, who feeds them to a saw that moves backward and forward as if it were madder than a snake. This saw chews out the slot that the washerwoman shoves down over the clothes on the line, and the clothes pin is ready, all but kiln drying and polishing.

"The latter is done in a revolving iron cylinder, the same as castings are cleaned. All these processes cost money, and when the manufacturer comes to put up his goods for sale he finds that his profit on the 48,000 pins, his day's work, is only about $193. We pay the manufacturer a cent a dozen, or a trifle more than $8 a thousand. We are compelled, in these close times, to sell them for 4 cents a dozen, or $32 a thousand."

Car Axle Frictions.

At a recent meeting of the American Society of Civil Engineers, a paper was read by A. M. Wellington, C.E., giving the details and results of experiments with a new apparatus upon the friction of car journals at low velocities. These experiments were undertaken to test the correctness of a series of tests described in a previous paper, which were made by starting cars from a state of rest down a known grade, and deducing the resistances from the velocity acquired. The present experiments were made by an apparatus in which the axle to be tested is placed in an ordinary lathe having a great variety of speeds, the resistance of the axle being measured by the levers connected with a yoke encircling the axle and transmitting the pressures to a suitable weighing apparatus. It was found important that this weighing apparatus should be direct, as, for instance, a platform scale rather than a spring scale. The results of these experiments as to initial friction were that friction at very low journal speed is abnormally great and more nearly constant than any other element of friction.

This abnormal increase of friction is due solely to the velocity of revolution. At velocities slightly greater, but still very low, the friction is still large, the coefficient falling very slowly and regularly as velocity is increased, but being constantly more and more effected by differences of lubrication, load, and temperature. A very slight excess of initial friction would generally be observed.

There is no such thing in journal friction as a friction of rest in distinction from a friction of motion. The fact that friction of rest appears to exist is due solely to the fact that no journal or other solid body can be instantly set into rapid motion by any force, however great. At ordinary operating velocities the character and completeness of lubrication seem to be much more important than the kind of oil used, or even the pressure or temperature.

Comparisons were made of experiments by Prof. Thurston and by Mr. Tower, and the experiments of the author. The rolling friction proper in railroad service seems to be very small indeed, not exceeding one pound per ton. As to the resistance of freight trains in starting, it is believed that the resistance at the beginning of motion in each journal is about twenty pounds per ton. A velocity of from one-half to three miles an hour must be obtained before the journal friction falls to ten pounds per ton. At six miles per hour the journal friction is at least one pound per ton higher than at usual working speeds. Temperature exerts a very marked adverse influence upon friction at low velocities. The velocity of lowest journal friction is 10 to 15 miles per hour. With both or other very perfect lubrication there is very slight increase of journal friction accompanying velocities up to 55 miles per hour. With less perfect lubrication, as with pad or siphon, greater velocity is apt to decrease as to increase the coefficient. The latter being more like the ordinary lubrication in railroad service, we may say without sensible error that the coefficient of journal friction is approximately constant for velocities of 15 to 50 miles per hour.

Silvering Plate Glass.

Silvered plate glass is produced by causing a slight coating of mercury to adhere to the glass. To obtain this result mercury must be retained by a metallic medium; it is, therefore, amalgamated with tin. Mercury, owing to its power of reflecting light very brightly, has been chosen as the best medium.

The operation of silvering is briefly as follows: Upon a very smooth stone table a sheet of very thin tin is spread very carefully, so as to prevent all wrinkles. Upon this sheet mercury is rubbed all over, then as much mercury as the sheet will retain is poured over it. The glass plate is now carefully slipped over the edge of the stone table, as near as possible to the mercury, and lowered on to it. All the parts previous to this operation have been carefully cleaned, and the plate is handled with pieces of tissue paper, to prevent the introduction of dirt. The plate is now covered with a cloth, and loaded with weights to expel the surplus mercury. When the plate has been weighted, the table is slightly inclined, and gradually increasing the inclination from time to time, until the mercury has been sufficiently drained; this generally requires twenty-four hours. The plate is now carefully taken up and carried over to an inclined wooden table, which is depressed gradually more and more to finish draining the mercury until the plate is supposed to be dry.

This is the process which has been heretofore followed altogether, but of late plates have been silvered with a solution of silver. Mercury has deplorable effects upon the health of workmen, as they are exposed to its dangerous emanations; these are rapidly absorbed by the skin and produce the well known and terrible mercurial poisoning. It is hoped, therefore, that mercury will be abandoned, and the new silvering process described below will be adopted in its place. Several methods have been proposed for silver solutions, all springing, however, from the discovery of Liebig, that aldehyde (produced by a partial oxidation of alcohol), when heated with nitrate of silver, the revivified metal covers the glass with a brilliant metallic coating.

Pettijean's operation, now used altogether by the St. Gobain works, is very similar to silvering with mercury. The table, instead of being stone, is a hollow sheet iron table, made quite smooth on its upper surface, and containing inside water capable of being heated by steam, to bring the temperature to 95–104 degrees. Preparatory to silvering the glass it should be thoroughly cleaned. The table being ready, a piece of oil cloth is spread over it, and upon this is laid a piece of cotton cloth. The plates are now put upon these cloths, and the following solutions are poured over them:

Liquor No. 1.—Dissolve in a liter of water 100 grammes of nitrate of silver; add 62 grammes of liquid ammonia of 0·880 density; filter, and dilute with sixteen times its volume of water. Then pour in this liquor 7·5 grammes of tartaric acid dissolved in about 30 grammes of water.

Liquor No. 2.—This liquor is precisely the same as the other, with the exception that the quantity of tartaric acid is doubled, say 15 grammes.

First pour of liquor No. 1 upon the plates as much as will remain upon the surface without running over. The heat of the table is now increased gradually to 95–104° Fah., and in about thirty minutes the glass is covered over with a metallic coating. The table is now inclined and the plates washed with water, which carries off the surplus silver. The table is again raised, and liquor No. 2 is now poured over; in about a quarter of an hour another coat is deposited, which covers the glass completely. The plates are again washed; then they are carried to a slightly heated room, where they are gradually dried.

This operation, as will be seen, is quite simple, and is generally performed by women. The silver carried off in washing and that contained in the cloths is recovered again. Since glass silvered by this process is liable to be altered when exposed to the air, and the coating may become easily detached if not covered over with a protecting coat of paint, the silver pellicle is covered with an alcoholic copal varnish, put on with a brush, and when this is dry a coat of red lead paint is put on.

Plates silvered by this means have more brilliancy than with mercury, but as there is a slight tinge of yellow given to objects reflected by these mirrors, they were at first objected to. This objection has passed away, however, to a great extent, and the yellow reflection has been obviated by giving a slight coloration to the glass. It is said that the new silver process costs about 36 cents per square meter. Inasmuch as such works as the St. Gobian have adopted it, and as the terrible disorders caused by mercury may be thus avoided, there should be no hesitation in adopting this new process everywhere.

The use of platina has been tried for a reflecting surface, but owing to the somber appearance of reflected objects by looking-glasses prepared with it, has not met with a commercial success.—*Glassware Reporter.*

Scarlet Fever by Post and by Ice.

A correspondent of the *Medical and Surgical Reporter* narrates a case where it seems tolerably certain that scarlet fever was transmitted by means of a letter. At least, there is much less room for doubt than in many cases where such a course is popularly assigned. The outbreak was in a country house half a mile distant from the nearest neighbor, and the family had occupied the house for three years; the children had not been away from the farm for two months, and no one had been in the house who had the fever, or been where it was. In fact, no case of the disease had been known or heard of by the physician for some months anywhere in the county. It appeared, however, that the mother had received a letter from her brother only a short time before, stating that his family had just lost a child from scarlet fever. This letter contained a photograph. The letter was received only seven days before the first child was taken sick, and the children all handled the letter and the photograph.

A newspaper reports that scarlet fever has been spread in Gloucester City by school children having eaten ice which had been used by an undertaker on the body of a person dead of the disease. The children picked up the ice in the street.—*N. Y. Med. Jour.*

Poisonous Plants and Flowers.

There are many plants whose leaves, flowers, and seeds contain virulent poisons, which every one should know, so as to avoid them and keep children from them.

Buttercups possess a poisonous property, which disappears when the flowers are dried in hay; no cow will feed upon them while in blossom. So caustic are the petals that they will sometimes inflame the skin of tender fingers. Every child should be cautioned against eating them; indeed, it is desirable to caution children about tasting the petals of any flowers, or putting leaves into their mouths, except those known to be harmless.

The oleander contains a deadly poison in its leaves and flowers, and is said to be a dangerous plant for the parlor or dining room. The flower and berries of the wild bryony possess a powerful purgative; and the red berries, which attract children, have proved fatal. The seeds of the laburnum and catalpa tree should be kept from children; and there is a poisonous property in their bark. The seeds of the yellow and of the rough podded vetches will produce nausea and severe headache.

Fool's parsley has tuberous roots, which have been mistaken for turnips, and produced a fatal effect an hour after they were eaten.

Meadow hemlock is said to be the hemlock which Socrates drank; it kills by its intense action on the nerves, producing complete insensibility and palsy of the arms and legs, and is a most dangerous drug, except in skillful hands. In August it is found in every field, by the seashore, and near mountain tops, in full bloom, and ladies and children gather its large clusters of tiny white flowers in quantities, without the least idea of their poisonous qualities. The water hemlock, or cow bane, resembles parsnips, and has been eaten for them with deadly effects.

The water dropwort resembles celery when not in flower, and its roots are also similar to those of the parsnip, but they contain a virulent poison, producing convulsions, which end in death in a short time. The fine-leaved water dropwort and the common dropwort are also dangerous weeds.

The bulbs of the daffodils were once mistaken for leeks and boiled in soup, with very disastrous effects, making the whole household intensely nauseated, and the children did not recover from their effects for several days.—*The Drugman.*

New Orleans Exposition Building.

The Boston *Herald* says that the main building of the New Orleans exhibition is in some respects the most remarkable edifice ever built in this country. It is much the largest exposition building ever erected in the world. The architect has succeeded, at a moderate cost, in producing the largest single room, every part of which can be seen from any point, of which there is any knowledge. The building is 1,378 feet long by 905 feet wide, and covers 33 acres, or 11 acres more than the Philadelphia Centennial Exposition of 1876. There are 1,656,300 square feet of floor space, including gallery. The reader may form a better impression of the vast dimensions of the structure by imagining three ordinary city blocks one way and five the other covered by a solid roof. And, if he chooses to allow his fancy carry him still farther, he can picture a monster panorama of the world's industry, extending before his vision uninterrupted by a single object except the supports.

The active commercial rivalry of the different sections is aptly shown by the distribution of contracts for the materials. The roof, which will cover 1,000,000 square feet, is being made in Cincinnati. The window sashes come from Milwaukee, Wis. The glazing will be done by St. Louis parties. Four thousand kegs of nails are being shipped from Wheeling, W. Va. Nine million feet of Mississippi lumber will be consumed. A massive group in bronze, typical of America, to be placed over the main entrance, is being made at Canton, O., as are also a statue of Washington and Columbus, and coats of arms of all the States, which will appear in medallion form as part of the exterior ornamentation. Finely modeled cornices are being made at New Orleans. The building will be 60 feet high, with a tower 115 feet high, and the architect has been fortunate in rendering the exterior unique and attractive. A platform will be erected on the tower, reached by elevators, from which visitors may have an exceptionally fine view of the city of New Orleans, the exposition grounds, the Mississippi River, and the surrounding country. There will be one line of gallery extending around the entire circumference of the building, to which visitors will be carried by 20 steam and hydraulic elevators, representing all the manufacturers of these conveyances in this country.

The music hall, situated in the center of the building, will be 364 feet wide, and will comfortly seat 11,000 persons. A platform is being built for 600 musicians. To light the building with incandescent lamps will require 15,000 lights and 1,800 horse power. To light with the arc system will require 700 lamps, and 700 horse power to operate the dynamo. The total steam required for lighting and for the machinery hall will be at least 3,000 horse power. In this estimate is included the power for five arc lights of 36,000 candle power each, which will light the grounds. These are the largest single lamps ever constructed. The cost of this great structure, lacking no single desirable feature for the purpose intended, will only be about $400,000, and the other buildings will be proportionately inexpensive.

Guano Tests.

Probably there is no better method of determining the purity of guano than the combustion test, which is as follows: Pour half an ounce of the guano into an iron ladle, such as is used in casting bullets, and place it upon red hot coals until nothing but a white or grayish ash is left, which must be weighed after cooling. The best sorts of Peruvian guano do not yield more than 30 or 33 per cent of ash, while inferior varieties, such as Patagonian, Chili, and African guano, leave a residue of 60 or even 80 per cent. Genuine guano leaves a white or gray ash; and a red or yellow ash indicates the adulteration with earthy matter or sand, etc. This test is based upon the fact that the most important ingredients, viz., the nitrogenous compounds, become volatilized, and escape when subjected to a sufficient amount of heat. The difference of odor of the vapors evolved in the process, according as we are working with first or third class guano, must also be noticed. The vapors from the better kinds have a pungent smell like spirits of hartshorn, with a peculiar piquancy somewhat resembling that of rich old decayed cheese, while those arising from inferior varieties smell like singed horn shavings or hair.

A Cheap Insect Destroyer.

A correspondent of the *Fruit Recorder* says he has boiled leaves and stems of tomato plants until the juice is all extracted, and finds the liquor deadly to caterpillars, lice, and many other enemies of vegetation. It does not injure the growth of plants, and its odor remains for a long time to disgust insect marauders.

AMERICAN INDUSTRIES.—No. 92.

MACHINERY FOR MANUFACTURING PAPER.

With the utilization of many new raw materials in the paper manufacture during the present generation, numerous improvements have been made in the machinery used by paper makers. There has been a great increase in the amount of all kinds of paper used—from cheap postage and low priced books and newspapers—but the competition of paper makers has been close, and they have been quick to adopt and fertile in suggesting improvements in machinery, whereby the product might be bettered or hand labor reduced. In this department of the world's industry American paper makers, and manufacturers of improved machinery therefor, now easily hold a leading position.

In the SCIENTIFIC AMERICAN of last week we gave some particulars of the paper manufacture, as conducted by one of the principal houses in that business; and we herewith present illustrations of many of the special machines used in the transformation of rags and other fibrous materials into paper, as they have been improved and are now made by the Pusey & Jones Company, of Wilmington, Del.

In mentioning the several machines as they come in natural order in the paper manufacture, the first would be the rag cutter, a machine which has been only a few years used instead of cutting up the rags by hand. This is a solidly built machine, into which the rags are drawn from an apron by a toothed cylinder, and meet another rapidly revolving cylinder on which are knives that cut them almost as would a pair of shears. The machine works very rapidly, and the bearings are adjustable, so that the shaft on which the cutting cylinder runs can be always kept true in its place without regard to the amount of wear it may have had.

The rotary boiler, to which the rags go after cutting, dusting, and assorting, is strongly made, the clamped covers shown indicating the openings through which the rags are introduced, with a small cock for the escape of steam. The steam is supplied to the boiler through the hollow trunnion on which it revolves. In order that the trunnions may be entirely true, the rotary boiler is placed in a turning lathe, after it is in other respects finished, and the journals are turned to the required size. The occasional explosions of these boilers in paper mills have been the subject of various conjectures as to their cause, as the steam here could not naturally be of greater pressure than that of the generating boiler whence it comes. The company explain these explosions as due to the supply, in such instances, of superheated steam coming suddenly into the boiler and flashing the large amount of water therein at a lower temperature into steam, and they are always careful to advise their customers to use generating boilers which cannot superheat the steam. The three styles of pumps shown are each of a special design, such as found best fitted for the use of the paper manufacturer. The "stuff pump" is that which takes the pulp from the stuff chest and delivers it to the "three-way box." It is very regular in its operation, intended to deliver a very close gauge of the amount of stuff needed, and to allow of such quantity being easily regulated. The "three-way box" nicely regulates the flow of the pulp to the paper machine, and the fan pump and the three-way plunger are used to dispose of the water, which is abstracted from the fluid pulp in its transition into a sheet of the fiber and strength of finished paper.

Although we do not give here a full view of the Fourdrinier machine, to show which properly would require a very large illustration, the machine itself, and all the machinery used in connection therewith, are specialties in the manufacture of the Pusey & Jones Company.

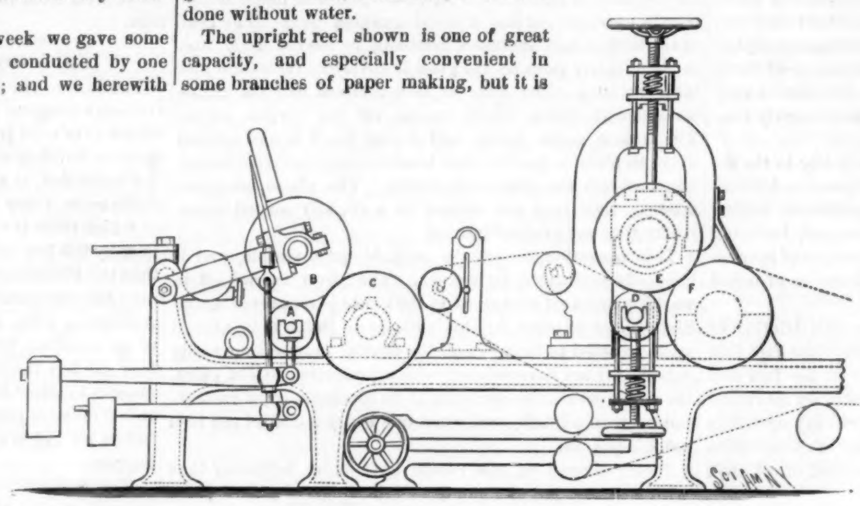
The "Gould screen," shown in one of the first page views, is a quite recent improvement in connection with the working of the machine. It is a substantially built frame, in which the pulp passes, on its way to the wire cloth, through brass plates in which are saw cuts of a width of one-hundredth part of an inch. These plates are vibrated a thousand times a minute, and the dirt and material not suitable to enter into the sheet of paper remain on the plates, not passing through with the pulp.

The couch and press rolls, shown above, indicate the portion of the machine where the pulp has been sufficiently dried to be taken off the wire on an endless belt, and then off the felt to pass over the drying cylinders. Several comparatively recent improvements are shown in these rolls, among which are the setting of the large rolls at the angle shown, instead of perpendicularly, as formerly; and the introduction of the third roll, whereby the moisture is more quickly taken out, and the work of compressing and strengthening the fiber more efficiently performed than was formerly done with the large rolls only.

The calendering machines come properly at the end of the paper making machine, or in the case of super-calendering this operation is performed afterward, to give the hard, polished surface one sees on writing and fine printing papers. There are views given of two styles of calendering machines, between the rollers of which the paper is passed, getting, besides the weight of the rollers themselves, a pressure from the binding force with which these rollers can be held down upon each other by screws in the supports for their bearings.

In the super-calendering machine shown, five of the rolls are of paper and the others chilled iron, each 42 inches long. The chill is given by casting in heavy iron moulds, and extends in about a half to three-quarters of an inch. The paper rolls are made by pressing hemp paper around a mandrel with such pressure as to make the paper roll as solid and almost as heavy as iron, so that the face can be turned and ground down true, though this must be done without water.

The upright reel shown is one of great capacity, and especially convenient in some branches of paper making, but it is



COUCH & PRESS ROLLS.

only one of several kinds of reel made for taking the paper as it comes from the machine.

The expanding pulley is a device of especial importance in the running of a paper machine. As will be seen, it provides for enlarging the circumference of the wheel by adjustable arms from the axis, so the shafts of couch or press rolls, or the driers, or any other part of the machinery, may be run at a speed proportioned to that at which the paper is coming through. This varies materially in different varieties, the paper being decreased in length much more under some conditions than others, and the expanding pulley allowing of the adjustment of the different parts of the machine in accordance therewith.

The roll grinding machine is a comparatively modern improvement for grinding and polishing the rolls. Formerly it was not uncommon to effect this by setting up the rollers in stack, and finishing them by the grinding of their surfaces against each other. The work must, of course, be done very true, as the rollers have to meet each other so nicely at all points that a ray of light will not pass between them. This is now accomplished by the machine shown, in which,

RAG-CUTTING MACHINE.

the roller being revolved, a carriage carrying swiftly revolving corundum wheels is moved backward and forward along its face.

The machinery used for making localized fiber, long since adopted by the government, and used for bank notes, bonds, etc., was made at the establishment of the Pusey & Jones Company, and, besides the machinery made here for American paper manufacturers, there is scarcely ever a period when there is not work of this kind under way for foreign customers.

The company has filled orders for paper manufacturers in nearly every part of Europe, and more than one paper mill in Japan now furnishes a practical illustration of the working of the paper making machinery of the Pusey & Jones Company.

Making a Time Card.

To one not familiar with the details of time card making, says the Detroit *Free Press*, the process is an interesting one. As practiced on all the divisions and branches of the Michigan Central, a large blackboard is brought into use as the primary or original time card. This board is ruled perpendicularly into 24 equal spaces representing the hours, and each of these spaces is similarly ruled into 12 smaller spaces, each representing five minutes.

The board is also ruled horizontally, but the horizontal lines are not placed at equal distances, as the perpendicular ones are. Each line here represents a stopping place—station or railroad crossing—and their distance apart is made proportionate to the actual distances on the road. Strings with weighted ends represent trains; light ones passenger trains, and dark ones freight.

A train is to leave Detroit say at 8 o'clock in the morning, and to arrive in Chicago at 6:40 P.M. A pin is stuck in the board at the top at the point where the line representing Detroit crosses the 8 o'clock line, and another at 6:40 P.M. on the Chicago line. The string is suspended from the former pin, swung over the lower, and the weight attached to it draws it taut, causing it to form a straight diagonal across the board between these two points. Now, if the road were perfectly straight and level, and there were no stops, this line would represent the time card of the train between Detroit and Chicago, running at an equal rate of speed the whole distance. But the train stops five minutes at Jackson. By two pins stuck in the line representing Jackson, five minutes apart, the string is carried over one space on a horizontal line. A 20 minute stop at Marshall is indicated in the same manner. Between Ypsilanti and Jackson the train slows up on account of the numerous curves in the road, and this fact is indicated by carrying the string on the Jackson line a little to the right, making it pass more horizontally and to cross a larger number of time parallels. Beyond Jackson, where time is made up, it assumes a more perpendicular direction. So, by placing pins at each station, giving more time where it is needed and deducting time where greater speed may be made, the string is given a more or less irregular or zigzag line across the board, and represents pictorially all the movements of the train.

An east bound train is represented in the same manner, except that the starting point being at the bottom of the board, the string makes a diagonal crossing the other. The point where they actually cross will represent the passing of the two trains.

These time cards, after being so made up, are left hanging in the time card room until the next change. Meanwhile the path represented by the train string is translated into figures, and printed for the use of employes and the public.

The Extinction of Deer.

It is stated by Engineer Phillips (late of the Northern Pacific Railroad) that no fewer than 20,000 elk, antelope, and mule deer are slaughtered every winter in Minnesota, Montana, and Wyoming alone. There is every prospect that three of the noblest game animals on the American continent will soon be entirely extinct. Elk, which formerly ranged from the Middle States to the Pacific, are now never found east of the Missouri River. Twenty-five years ago they were plentiful in Kansas and Nebraska, but civilization has driven them into the dense and uninhabited regions of Minnesota and the Northern Territories. The hide hunters effect the most sweeping destruction. The average price of an elk skin is $3. The hide hunters use repeating rifles, and frequently kill from six to twelve elk in a herd before they get out of range. Mr. Phillips affirms that, besides the slaughter of the animals named, in the year 1882 more than 25,000 buffaloes were killed for the traders between the Yellowstone and the head waters of the Little Missouri.

If there is to be sport in the Great West in the future, those interested will be compelled to move for legislation which will give protection to game in the Western States and Territories. Otherwise there will be very few elk, buffalo, mule deer, or antelope left to hunt in five years.

Correction.—Mercury Intensifier for Gelatine Plates.

We are informed that the formula given on page 352 of current volume is incorrect in some respects. For 10 grains of bichloride of mercury, 60 should be substituted. The correct formula is as follows:

No. 1.

Water	20 ounces.
Bichloride mercury	60 grains.

No. 2.

Water	4 ounces.
Iodide potassium	190 grains.

Pour number one into number two. If it works too fast, dilute with water.

FIRE ESCAPE.

The sides of the block are united by four friction pins, arranged on two diagonal lines, and over which the rope or wire is passed (as clearly shown in the engraving). The rope is also passed over pins at the top and bottom of the block. At each end of the block is pivoted a brake lever, the inner ends of which press the rope against the pins. On a rod secured to one of the outer side surfaces of the block runs a traveler, to which one end of a belt of leather or webbing is secured, the other end of the belt being provided with a hook to be passed over the rod.

To use the escape, one end of the rope is hooked in the

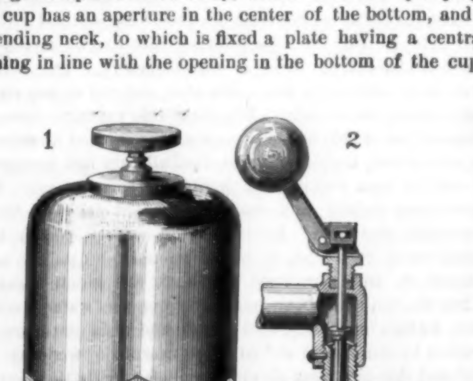
WARE & RICHMAN'S FIRE ESCAPE.

window sill, and the other end thrown out of the window. The belt is passed around the body, and the hook clasped over the side rod. Then the person steps out of the window and slides slowly down the rope, the friction pins in the block preventing a rapid descent. By means of the brake levers the apparatus can be stopped at any time. When the block arrives at the ground, the person unfastens the belt, and the block is pulled up again to be used by another person, who throws the end of the rope that had been fastened in the room out of the window, and secures the opposite end. The device is portable, takes up a small space in a gripsack, and weighs but little.

This invention has been patented by Messrs. David Ware and C. W. Richman, of 900 Walnut Street, Philadelphia, Pa.

LUBRICATOR AND MEASURE.

The lubricator herewith illustrated automatically feeds oil in measured quantities to the valves of locomotives after the steam has been shut off. Slight changes adapt the device to the measurement of liquids. Fig. 1 is a vertical sectional elevation of the lubricator, and Fig. 2 is a sectional view of the device adapted to measure liquids. The oil cup is filled through an aperture in the top, which is closed by a plug. The cup has an aperture in the center of the bottom, and a depending neck, to which is fixed a plate having a central opening in line with the opening in the bottom of the cup.



PETER'S LUBRICATOR AND MEASURE.

The apertures and the neck are formed with interior screw threads to receive a screw plug consisting of a neck entering the cup aperture, a screw plate fitting in the neck, and a lower neck portion fitting in the lower plate. The neck upon the cup forms the side walls of the oil measuring chamber, the bottom of the cup forms the top, and the plate the bottom. In the neck is fitted a double plug valve having upper and lower heads, which seat themselves alternately at the top of the upper neck and at the bottom of the screw plate. Passages lead from the oil to the measuring chamber, the stem of the valve being shaped so as to allow free flow of oil from cup to chamber when the upper valve is opened and the lower one closed. When the upper valve is closed and the lower one opened, the oil in the chamber passes into the valve chest of the engine cylinder.

When the engine is taking steam, the steam pressure seats the lower valve and opens the upper one, thus allowing the oil to flow from the cup into the chamber. When the throttle valve is closed and the steam shut off, the upper valve seats itself, thereby shutting off the flow of oil from the cup, and the lower valve opens to allow the oil in the chamber to escape to the steam chest to lubricate the valves when they are running over their seats while the engine is slowing down. By this arrangement the valves receive oil when they are not being lubricated by steam, and when effective lubrication is most needed. The oil chamber can be enlarged or contracted at will by simply screwing the oil cup up or down, and by screwing the bottom of the cup down to the screw plate all flow of oil from the cup will be prevented.

Fig. 2 shows this principle applied to the measuring of liquids. The measuring chamber is connected to the outlet from the vessel containing the liquid. When the valves are in the position shown in the drawing, the liquid fills the chamber. Moving the lever changes the positions of the valves, closing the upper and opening the lower one, through which the measured liquid is drawn off. An upwardly closing vent plug insures the discharge of the liquid from the chamber. The device can be readily adjusted so as to measure any desired quantity.

This invention has been patented by Mr. John S. Peter, of Angelica, N. Y.

The Properties of Starch.

A number of interesting papers on this subject have lately been published by Messrs. F. Musculus, Brukner, and others, whose researches throw considerable light on the properties of starch, and show how it may be distinguished from the different varieties of dextrine with which it is frequently confounded. The first named investigator especially criticises Solomon's recent paper, who treated only of crystalline starch, completely ignoring the amorphous variety. According to Musculus, dilute solutions of crystalline soluble starch give a red coloration with iodine, but concentrated solutions yield a blue color; this crystalline variety dialyzes slowly, and reduces Fehling's solution on boiling; on the other hand, the amorphous modification is soluble in cold water, and always gives a blue coloration with iodine; it cannot be dialyzed, and it does not reduce Fehling's solution. Brukner has especially studied the iodine reaction, and is of opinion that the so-called iodide of starch is not a chemical compound; he considers that the blue color is simply due to the solution of iodine in potato starch, just as violet and brown colors are obtained on solution in chloroform and water respectively. Brukner also states that potato starch yields a blue color, while wheat and rice starch yield violet; but after boiling, the latter are also turned blue by iodine.

CAR AXLE BOX.

Formed upon the top of the housing, A, is an oil chamber, E, that is made with a separable cover. In the center of the bottom of the oil chamber is a boss, G, in which is a vertical hole passing through the top of the housing, and having in its upper part a screw thread, and having its lower part tapered, as shown in Figs. 1 and 2. Oil conducting grooves lead to the base of the boss, where they connect with channels leading to the lower part of the hole. The flow of oil from the chamber can be regulated by the screw, H, whose lower portion is tapered. A jam nut holds the screw in any desired position.

The wedge, J, has a recess formed in its upper side to receive oil from above, and has a hole in its middle part to allow the oil to pass through it. The forward movement of the wedge is limited by a shoulder formed upon the under side of the housing. In order to give it a slight longitudinal play, the wedge is made a little shorter than the space between the shoulder and the inner end of the housing. For convenience in inserting and removing, the wedge has a lip upon the under side of its outer end. Upon the lower side of the wedge are flanges forming a dovetailed groove (Fig. 4) for receiving the dovetailed projection formed upon the upper side of the brass, K (Fig. 3). The movement of the brass is limited by a flange connecting the outer ends of the side flanges. In the brass is made a recess to receive the oil, and through the brass is an opening to conduct the oil to the journal. The journal has a slight play upon the brass, and the latter a play upon the wedge, which has a play upon the top of the housing.

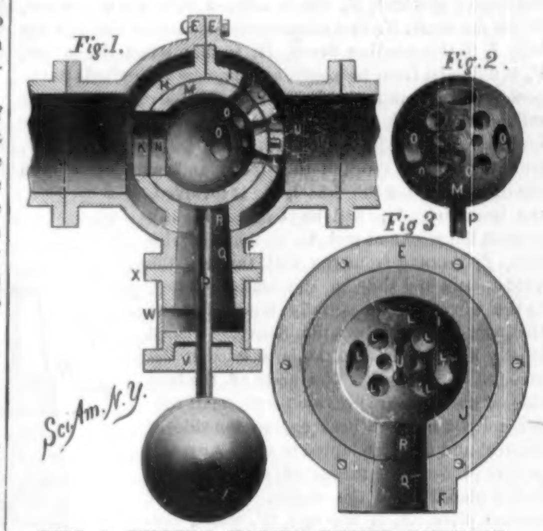
The cotton waste is placed in a cellar box under the journal box, and is held against the journal by curved springs placed in the bottom and attached at one end to the box, which has a closed bottom and fits snugly in the journal box, so as to catch and hold all the refuse oil. This oil is prevented from working out beneath the journal by a guard plate, M, placed between the parts of the double walled end of the box, and held up by spiral springs. The outer end of the journal box is provided with a door, B, clearly shown in Fig. 2.

This invention has been patented by Mr. M. R. Carey, of Mauch Chunk, Penn., who may be addressed for further particulars.

MARINE ENGINE GOVERNOR.

In the accompanying engraving is shown a marine engine governor constructed in such a manner as to shut off steam automatically when the vessel rolls and pitches. The two parts, A B, forming the shell are constructed with flanges at their outer ends for convenience in connecting with the ends of the steam pipe, and at their adjacent ends are flared into spherical form and made with flanges, E, by which they are united. In the lower side of the shell is an opening provided with a fixed collar, F, having a flange at its outer end. Within the shell are placed semi-spherical plates, H I, which have flanges around their edges to fit into the rabbeted parts of the shell, and an opening in their lower side corresponding with the opening in the shell.

Steam is admitted into the space between the two spheres, A B and H I. In the center of the part, H, is formed a



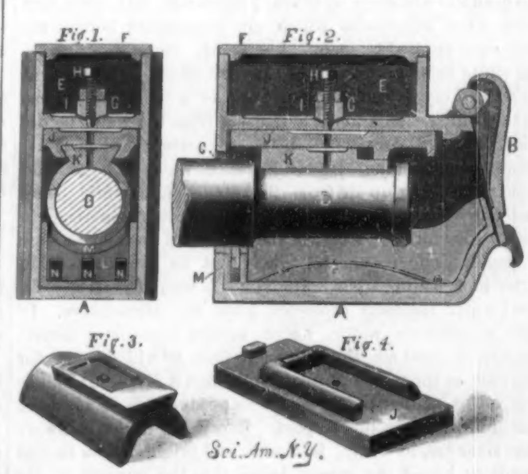
BELL & FULLER'S MARINE ENGINE GOVERNOR.

large opening, K, and in the other part are formed small openings that are either circular, square, or of other desired shape. Within the sphere, H I, is fitted a hollow sphere, M, having an opening, N, in one side corresponding with the opening, K, and in the other side are openings, O, corresponding in shape, size, and number with the openings, L. Upon the lower side is rigidly attached a stem, P, which passes out through openings, and has on its lower end a weight sufficient to hold the stem in a vertical position and the sphere, M, stationary, thereby causing the sphere, H I, to turn upon the sphere, M, as the vessels rocks and pitches. This movement partly or wholly closes the openings, L O, resulting in the steam being partly or wholly shut off and the slowing or stopping of the engine. The sphere, M, is prevented from rotating upon the stem, P, by a pin, T (Figs. 1 and 2), which enters a vertical groove, U (Figs. 1 and 3), in the inner surface of the sphere, H I. The lower part of the stem passes through a stuffing box, V, attached to the outer end of a short, flexible hose, W, whose inner end is secured to the collar, F, either directly or by means of the flanged collar, X. This construction prevents the escape of steam, and allows a free lateral movement of the lower end of the stem.

This invention has been patented by Messrs. A. H. Bell and A. Fuller, and further particulars may be obtained by addressing the latter at No. 10 Renwick Street, New York city.

Plant Nut Trees.

The Baltimore *Market Journal* says: "The idea of planting edible nut bearing trees where shade is desired, instead



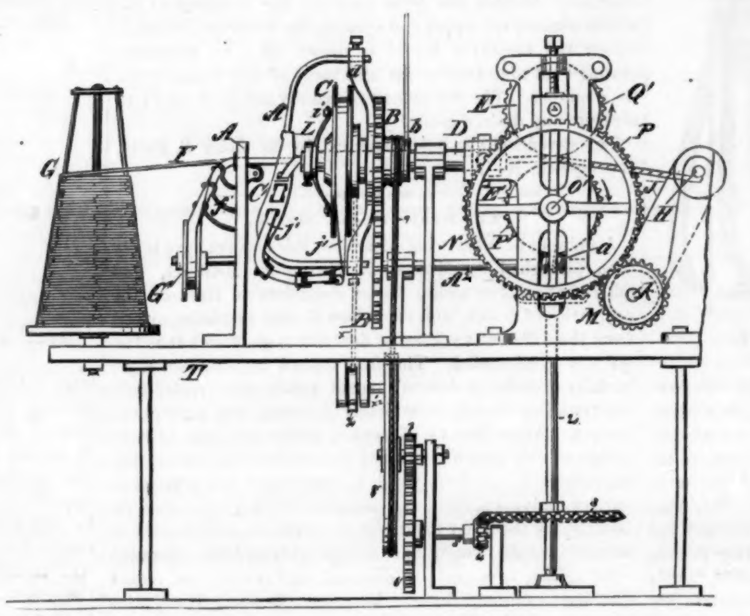
CAREY'S CAR AXLE BOX.

of those which are solely ornamental, is not new, but the suggestion is one that will bear thinking about by those who contemplate planting shade or ornamental trees. Chestnut, walnut, hickorynut, and butternut trees are all nearly as fine in appearance as horse chestnut and maple, and, aside from the source of revenue, which will in time accrue to their owners from the fruit, the timber of such trees is always in demand, and the tree itself may become profitable should it become desirable at any time to remove it.

WIRE WRAPPING OR COVERING MACHINE.

The accompanying drawing shows a side elevation of a wire covering machine, recently patented by Mr. Charles Conner, of Ashtabula, O. The reel, C, on which the ribbon, j', is wound, is journaled loosely upon the sleeve, D, upon which is also journaled the cog wheel, B, upon one side of which is formed the cone pulley, b, and upon the other side the radial arms, d, in the outer ends of which is held the bent rod, A', to which are attached the ribbon tension plate, C', the guide plates, and friction rollers. The cog wheel, B, meshes with the cog wheel, B', arranged upon the shaft, A^2. Keyed upon this shaft is a worm that meshes with a cog wheel upon one end of the shaft, O'. The beveled cog wheel, P, is normally keyed to the shaft, but may be easily loosened. The cog wheel, P', meshes with the wheel, Q', and upon the other end of the shaft, O', is the large cog wheel, N, which meshes with the cog wheel, M, on the shaft, K, that communicates motion through the belt, J, to the winding drum, H, so that when the wheel, P, is unkeyed from its shaft, and power is applied to the cone pulley, b, and wheel, B, revolved, the rubber drawing rollers, E E', and drum, H, will be revolved through the system of gearing just described, for drawing the wire, F, from the reel, G, through the sleeve and winding it upon the drum. When the wheel, B, is revolved, the bent rod, A', will be carried rapidly around the wire and reel, C, so that the ribbon, j', passing from the reel through the guide plates and slots in the tension plates, to the wire, will be spirally wrapped upon the wire in front of the sleeve. Placed loosely upon the sleeve, D, is a tension device for the reel, C. The ends of the bow shaped piece, L, are provided with small rubber rollers, i, which bear against the side of the reel and can be adapted to exert a greater or less pressure by means of an adjustable collar placed upon the sleeve. In front of the eye plate, A, is the reel, G', which carries the ribbon that is first to be folded around the wire.

When the cog wheel, P, is unkeyed and the machine operated by power applied directly to the pulley, b, the gearing beneath the table remains idle. When this mechanism is to be used, the worm, a, is removed from contact with the wheel, P', which is firmly keyed to its shaft. Power is then transmitted by the wheels, M and N, to the beveled wheel, P, which meshes with the beveled wheel on shaft 2. Power is then transmitted as clearly shown to the cord, 9, which passes over the pulley, b. The shaft, X^2, is mounted in hangers beneath the table, and carries the pulley, X, and a friction wheel bearing against the wheel, 8. A cord leading from this pulley to a pulley on the side of the reel revolves the latter when ribbon is to be wound upon it.



CONNER'S WIRE WRAPPING AND COVERING MACHINE.

What Makes Ice White and Opaque.

It is a law of light that in passing from one substance to another possessing a different power of refraction a portion of it is always reflected. Hence when light falls upon a transparent solid mixed with air, at each passage of the light from the air to the solid and from the solid to the air a portion of it is reflected; and in the case of a powder this reflection occurs so frequently that the passage of the light is practically cut off. Thus, from the mixture of two perfectly transparent substances we obtain an opaque one; from the intimate mixture of air and water we obtain foam; clouds and snow owe their opacity to the same principle; as also does the whiteness of crushed diamonds, salt, glass, and many other substances which are transparent before the pressure is applied to them. Ice being, therefore, opaque and white in proportion to the amount of air it contains at the time of crystallization, it follows as a matter of course that anything which tends to expel it from the water before it is frozen will contribute to its transparency when it assumes the solid state. If, for instance, water be boiled and kept from taking up air from the atmosphere while being cooled to 32 degrees, the result will be perfect transparency in the ice thus formed, whether the process of freezing be slow or rapid. The reason for this is that no air can exist in water in a boiling state. The same is true of perfectly filtered water similarly protected from the atmosphere. In case of ordinary water, which always contains a certain amount of fixed air, the ice made from it will depend for its color on the temperature under which it is frozen; and as this varies, neither ponds nor rivers produce ice of anything like uniformity in this respect. Every ice dealer is aware that river ice, as a rule, is clearer and brighter than that of ponds or lakes; the reason being that the current in the river aids the crystallizing force to expel the air, which in still water, especially in very cold weather, is caught up and embedded in the ice, thus affecting its color and, to a slight degree also, its density and durability. Against these advantages in favor of running streams we must put the larger yield in ponds, the lesser liability to damage from sewage, storms, and freshets, and, though last not least, the increased quantity of oxygen and carbonic acid which make ice on ponds both more palatable and digestible than that of running streams.

It will thus be inferred that the only real advantage in favor of river ice is its greater transparency when produced in very cold weather, and that if some feasible and cheap method of eliminating the air from pond ice can be invented and applied, the only popular objection to it would be removed, and ice as bright and transparent as that of the Kennebec or Penobscot rivers could be obtained from a multitude of home sources, and the cost of harvesting, transportation, and waste would be greatly reduced. While fully conscious of the difficulties to be encountered by those now engaged in solving this problem, we have never entertained any doubt of its ultimate accomplishment, and that at no distant day, and its success will undoubtedly prove a rich mine of wealth to the inventor. The whiteness and opacity of ice being unquestionably due to the presence of air cells, it is simply a question whether the required motion can be artificially created in ponds without impeding the process of solidifying, and at a cost which will not materially affect the first cost of production. This is the whole thing in a nutshell.

In estimating the value of such an invention to the ice trade, it must not be lost sight of that the quantity as well as the quality of pond ice would be thus improved, for it is equally well known that water from which the air has been expelled, whether from boiling, filtering, thawing, or any other process, will freeze faster under a given temperature than water largely impregnated with atmospheric air. This can be readily tested by filling two glass vessels, one with common hydrant or river water, and the other with water that has been boiled or filtered (but sealed in the interval from the outer atmosphere), and then subjected to a like freezing process. The latter specimen will be the first to solidify. The reason for this is that air in water tends to weaken the cohesion of its particles, and thus retards crystallization. As an illustration of this fact, M. Donny, a distinguished French scientist, has proved that if water be thoroughly purged of its air a long glass tube filled with this liquid may be inverted, while the tenacity with which the water clings to the tube, and with which its particles adhere to each other, is so great that it will remain securely suspended, though no external hinderance be offered to its descent. Owing to the same cause, water deprived of its air will not boil at 212 degrees Fah., and may be raised to a temperature of nearly 300 degrees without boiling, but when this occurs boiling is attended with an explosion.

We might extend this discussion to an almost unlimited extent, but we have already said sufficient to show that the efforts now being made to increase the quantity of pond ice and improve its quality possess an importance to the ice industry which can hardly be exaggerated, while they are full of promise as to their ultimate issue.—*Ice Trade Journal.*

How to Destroy May Beetles.

A writer in *Vick's Magazine* relates his mode of destroying the May beetle, or June bug. He states that he has practiced his method for the past five or six years with the most satisfactory results.

"In the first place, I save all the trimmings of trees, bushes, and litter of every kind which will burn and make a good blaze. I keep it all until the period arrives at which the beetle commences to fly in the evening, as they are nocturnal insects. I then commence building bonfires in several places in the evening, and keep them going for two or three hours for several evenings, making as much blaze and light as possible. The flames and light attract the beetles by hundreds and thousands, and the result is they fly in them and are burned up. At the time I commenced this practice I used to find thousands of beetles in the spring when I worked my fruit patches, but this spring there has been only one beetle discovered which I have heard anything about, and I presume he must have been an immigrant. In company with the beetles there are thousands of moths and millers fly into the flames and are destroyed, all of which, I believe, prey upon vegetation."

Turning, Cutting, and Polishing Stone.*

Alabaster and marble can be turned with any ordinary metal cutting tool, or better, an old, worn out saw file; but great care is necessary when forming a moulding or bead not to spall the edges. The best plan is to work the tool from the corner in; when roughed near to size, begin by scraping with a flat-nosed tool, lightly, until complete; then get a piece of water Ayr stone, and go over the whole surface, keeping it well wet with clean water, until you have a good dull surface, and free from all scratches. Then, with an old linen or felt, made wet and sprinkled with putty powder, go over lightly, until you have whole surface polished.

Granite or onyx may be turned with a diamond, set as a turning tool, either by hand or in slide rest, to the shape wanted, and then ground to a surface with emery and a lap of zinc, and then with a second grit and with water Ayr, and polished the same way as before.

For cutting stone of hard nature get a disk of soft iron, about 6 inches or 8 inches in diameter and 0·01 inch thick, mounted as a circular saw, driven about 300 revolutions per minute, lubricated with water and a little soap occasionally on the sides of the disk; the disk to be charged on the edge with diamond dust, well embedded in, and care must be used in beginning the cut not to press too heavily until the disk has got a bite of the stone, or you will strip it of the dust. The piece to be cut is best cemented or fixed to a pivoted arm. I have cut specimens this way, $\frac{1}{50}$ inch thick and 2 inches diameter.

In cutting specimens for microscope slides it is better to cut them about $\frac{1}{16}$ inch thick and cement them to a piece of plate glass about 2 inches square, $\frac{1}{4}$ inch thick, with a little Canada balsam, using a gentle heat to help to evaporate; then when fixed they may be ground down to the required thickness by a lap made of thin zinc, nailed flat to a piece of wood, with fine emery and water, and a light rotary motion. Do not add fresh emery when the specimen is nearly transparent, but still work the same over until the scratches do not show. Then carefully clean the glass slip and cover ready for mounting. Apply heat to remove the specimen from the grinding slab, lifting it up when softened with the point of a needle, then place it for about a couple of minutes in a small drop of "turps," to remove the particles of emery in the grinding process. Then put a drop of Canada balsam in the center of the slip, hold it over a lamp, but do not let it boil, or it will produce air bubbles. When sufficiently hot lift the specimen with the point of a needle just tipped with balsam, so as to stick; carefully lay it on the hot slip gradually, so as to exclude the air. Then while hot put on the glass cover, and should there be any air bubbles, they can be drawn out by applying a hot needle to the cover, over the spot, and drawn toward the edge of cover, then the slide will be ready for test. Under the microscope some specimens require to be reduced to the 0·001 inch, to show their structure, while others show good at $\frac{1}{64}$ inch.

Treatment of Burns and Scalds.

Dr. C. F. Naismith writes to the *Lancet* that he has secured most excellent results from the following method:

At first, he used the soda solution, followed by carron oil, but soon abandoned them as unsatisfactory. The former owes its reputation to the cold water, and not to any soothing property in the soda. His invariable practice, however extensive the scald, has been to place the injured member in ice cold water, keeping it there until all pain had disappeared—say in from two to four hours, or even longer. The water heats rapidly, and must be kept cold either by ice or constantly renewing. As long as the scalded part is kept under water (provided it is cold enough) no pain is complained of, and symptoms of shock are much lessened. When the limb will bear removal from the water without pain, he lays on thickly lead acetate and resin ointment (one drachm to one ounce) and envelops in cotton wadding. He has used this ointment also in erysipelas with the best results, all symptoms of inflammation rapidly disappearing. Should severe suppuration occur, instead of the lead acetate a few drops of creosote may be added to the resin ointment, as recommended by Druitt. By this treatment pain and shock are reduced to a minimum, opiates are seldom required, and danger to life is, he believes, greatly averted.

Water in Steam.

Herr Stoupler, of Luzerne, Switzerland, by adding fluorescine to the water of a boiler, which by calorimetric test enabled him to detect the presence of one-half of 1 per cent of water carried mechanically out of the boiler by the steam, found that from 2·3 to 4 per cent was actually thus present in the steam. The deep green color of the water in the boiler was retained in it for weeks, and yet no trace of coloring could be detected in the water condensed in the steam cylinder, a proof that the water which gathers there is entirely due to condensation caused by the expansion of steam, and that very little water is actually mechanically carried away by the steam from boilers.

* C. E. Sibley, in *Amateur Mechanics.*

Correspondence.

Speed of Thought in Dreams.—De Quincey Excelled.

To the Editor of the Scientific American:

In your issue of May 24 is an article on "Speed of Thought," showing the rapidity of thought as shown by an engineer dreaming a long dream while traveling 250 feet in 4 seconds. A case happened here wherein the dreamer had an equally long dream in less than one second. A telegraph operator was one night during the Turco-Russian war receiving a press dispatch regarding the war, in which the name of Gortschakoff was being telegraphed. Gortschakoff's name appearing so often in such dispatches, the operator, as soon as he heard the first syllable of the great premier's name, went to sleep and dreamt he went to his mother's home in the Indian Territory; went hunting with some Indian friends; had a great deal of sport, and went through an experience which would take days to perform, and finally after returning from the hunt during the division of their game, he woke up in time to hear the final syllable of Gortschakoff's name, and succeeded in making a complete "copy" of the message. At the rate of 40 words per minute, at which telegraphing is usually done, you will see that the time of the dream, which commenced when the middle syllable of Gortschakoff's name was being made, was one-third of one and one-third of a second, or forty-four one-hundredths of a second. Yours, etc., R.

Sedalia, Mo., May 25, 1884.

The Oxygen in Water.

Dr. William Odling, F.R.S., recently lectured at the Royal Institution on "The Oxygen in Water." Sir Frederick Bramwell, F.R.S., presided.

Dr. Odling began by stating that in 1823 Faraday proved that a gas or vapor is nothing but a liquid at a temperature above its boiling point; and the lecturer exhibited a number of glass tubes containing liquefied gases, which had been prepared by Faraday, who liquefied nearly every known gas. It is only within the last six years that the five or six gases which had previously resisted liquefaction have been reduced to that state by perfected modern appliances for producing cold and pressure. At the present time a chemist in Paris is making liquid oxygen by the pound.

The speaker said that when gases are dissolved in water they somehow assume the liquid state therein, and increase the bulk of the water. At 0 deg. C. 100 volumes of water dissolve 4·11 volumes of oxygen gas; at 15 deg. C. they dissolve 2·99 volumes. At 0 deg. C. 100 volumes of water dissolve 6,886·10 volumes of sulphurous acid gas, and at 15 deg. C. 4,356·50 volumes. 100 volumes of water at 0 deg. C. dissolve 114,800·00 volumes of ammonia, and at 15 deg. C. 78,270·00 volumes. Water at a temperature of 45 deg. Fah. dissolves 2·199 cubic inches of oxygen per gallon, and at 70 deg. Fah. 1·797 cubic inches per gallon. The barometric pressure has a feeble influence in causing variation in the amount of oxygen absorbed by water, the variation not exceeding a small fraction of a grain per gallon; yet in a large river that means a variation in the quantity of oxygen to be measured by tons.

River water in summer contains about four grains of oxygen per cubic foot, and about five grains in winter. Every ten million cubic feet of water passing over Teddington Weir carry with them 17¼ tons of liquefied oxygen, or about 50 tons of liquefied air, when the water is at the temperature of 60 deg. Fah.

In August, 1859, Dr. W. Allen Miller ascertained the proportion of oxygen in the Thames at low water, and found that as the Thames runs through London, the quantity of oxygen in it diminishes as compared with the proportion it contains at Richmond; and discovered that about 12 or 13 tons of oxygen are lost between Richmond Bridge and Somerset House. Other chemists have since taken up the work, and their results agree tolerably closely. One method of testing the proportion of oxygen in water is by means of hyposulphite of soda—a salt in an inferior state of oxidation to the sulphite; the hyposulphite used is not that employed by photographers, which is, properly speaking, the thiosulphate of soda. The hyposulphite of soda used in the analysis of water bleaches the ammoniacal solution of oxide of copper; it also deoxidizes indigo, magenta, and iodide of starch. White indigo is made blue by the air in water, but does not do so if hyposulphite of soda is put in the water first to absorb the oxygen. When water is made blue by indigo, and hyposulphite of soda is added, the latter has the choice of two substances from which to absorb oxygen, and it deoxidizes the air in water first; hence the quantity of hyposulphite used before the liquid is bleached affords a method of measuring the proportion of oxygen in water. When the liquid is just bleached, by adding no more hyposulphite of soda than is necessary for the purpose, it can be made blue by pushing down air into it, or by pouring it from one vessel to another.

Tests of the Thames water show that at Erith, near the sewage outfall, it contains but about half a cubic inch of oxygen per gallon instead of 2 cubic inches per gallon; but lower down the proportion of oxygen rises again, until the water is within 10 per cent of its richness in oxygen at Richmond. Thus the considerable power which flowing water possesses of keeping itself sweet and clean is no longer a matter of speculation, but one of positive proof. Still the power, great as it is, may be overtaxed, and often is overtaxed in some cases, when the organic matter is non-living. As to whether it has the power of destroying those minute living organisms which are the germs of certain diseases, there are at present very great differences of opinion among chemists.

Pompeii.

POMPEII, February 10, 1884.—In two recently excavated houses the paintings on the walls are as fresh as if just put on, and the halls are rich with decorations. Some of the marble tables are still standing; the fountains in the atrium and peristyle, with their pretty little statues and mosaics, look as if they might begin to play at any moment; the kitchen hearths, built like ranges, seem ready for their pots and kettles; a few flower pots are still set in the gardens; in the storerooms are some oil jars and wine jars; it is as if one might begin housekeeping to-morrow, and invite one's friends to dinner the day after.

One thing is difficult to conceive without seeing it, and that is the gorgeousness of the interiors of the private houses. The colors are now faded; the columns are broken; the mosaics of the floors are generally nearly destroyed; the fountains do not play; the flower beds are destitute of flowers; yet, even as it is, one is continually amazed by the brilliant effect of the interior vistas. In one house the view from a triclinum across two courts, both surrounded by gayly decorated Corinthian columns standing before walls painted from top to bottom in a variety of colors, is really dazing to the eyes. The old Pompeians lived in a rainbow atmosphere.

Another striking thing is the absolute cleanliness. You may say that the dirt has all been taken away by the Italian Government. That is true, but it is quite evident that in the old times it never was there. Our modern houses are not made to be clean, as were the Pompeian residences. The walls, the floors, every corner of their homes, were finished with the most admirable workmanship. In their rooms no plaster ever fell, for it was of such excellent material, and so well put on, that it soon became like marble. They had no wooden walls, no cracks where dust could penetrate. Water for cleansing was found in every part of the house, and ran off through perfect drains. All the tables and bedsteads were of marble or bronze; even the well-curbs and the borders of the flower beds were of hewn stone. Hygiene must have come naturally to the old Pompeian; he evidently had no chance to get a typhoidal attack; the only class of diseases he could not provide against were the eruptive, and one of these carried him off at last. . . .

The excavations are going on steadily, and are admirably managed. It is a delight to see one room after another revealed to the light of day. The authorities are now beginning to replace the charred timbers of the roofs with new ones. In this way some second story balconies are kept in place, instead of being allowed to fall down as formerly. Over some of the most richly decorated houses the roofs are restored exactly as they were, with tiles made after the ancient patterns. . . .

You would be astonished at the size of some of the Pompeian houses, and of the rooms and spaces they inclose. They look small because they are so empty, but when you measure them you find them very spacious. Houses of thirty and forty rooms in the first story are not uncommon. The great space was the atrium, often 35 to 40 feet long, having an opening for light in the center of the roof, and just under this a marble lined basin, raised above the floor, into which the rain fell, and on the margin of which were placed bronzes and vases. Out of this opened bedrooms, and at the end a reception room and dining room. Beyond these was a peristyle, or court, surrounded by from eight to twenty columns, thus making a broad corridor running all around. Some of the peristyles were 80 or 100 feet square, with a great variety of rooms opening into them. Beyond the peristyle was the garden, sometimes 150 feet square, or more, with all sorts of arrangements for plants and fountains. A good many of the elaborate niche-shaped fountains are still perfect. The street entrances to some of the houses are 10 to 15 feet in width, and had quadruple or four-leaved doors. In fact, so spacious are these dwellings on the ground floor that it is generally believed that the upper story rooms were rented out. . . .

The floors of the first and second stories were of cement in which patterns of mosaic or tessellated work were laid. Many of these floors are uninjured. . . . The houses were admirably planned to save space; and the decorations, mural and otherwise, were far beyond our conceptions of the art of ornamentation. The workmanship, especially the plaster and stucco, was much better than can be produced by our modern craftsmen.

In examining Pompeii it is necessary to remember that it was a small provincial city, bearing about the same relation to Rome that Auburn or Utica does to New York. This increases our wonder in walking through its well paved streets, or its richly adorned houses, or about its theaters and temples and squares, or in studying the thousands and thousands of art objects in terra cotta, bronze, silver, gold, alabaster, marble, and glass, which have been discovered within its walls—even with less than half the city excavated.—*American Architect.*

IN England the mails are used for the transmission of nearly every species of merchandise. Fish, game, meat, butter, eggs, fruit, cream, and all other farm products are transmitted through the English parcels post at very cheap rates. In a word, the British Post Office really does the express business of the country.

Suicide and Sleeplessness.

The circumstances attending the recent death of the Dean of Bangor—albeit they are infinitely distressing—present no novel features. The reverend gentleman, according to the *Lancet*, was a man of considerable intellectual "power," which is the same thing as saying that he was constitutionally liable to intervals of mental depression. All highly intellectual men are exposed to this evil. A pendulum will always swing just as far in one direction as it does in the other. Great power of mind implies also great weakness under certain conditions. The marvel is not that great minds occasionally become deranged, but that they so often escape derangement. Sleeplessness means not merely unrest, but starvation of the cerebrum. The brain cannot recuperate, or, in other words, it cannot rest. Physiologically, recuperation and rest are the same thing. Sleep is simply physiological rest. The only cause for regret in these cases is that the blunder should ever be committed of supposing that a stupefying drug which throws the brain into a condition that mimics and burlesques sleep can do good. It is deceptive to give narcotics in a case of this type. The stupor simply masks the danger. Better far let the insomnious patient exhaust himself than stupefy him. Chloral, bromide, and the rest of the poisons that produce a semblance of sleep are so many snares in such cases.

Sleeplessness is a malady of the most formidable character, but it is not to be treated by intoxicating the organ upon which the stress of the trouble falls. Suicide, which occurs at the very outset of derangement and is apt to appear a sane act, is the logical issue of failure of nutrition that results from want of sleep. It is curious to note how a sleepless patient will set to work with all the calmness and forethought of intelligent sanity to compass his death. He is not insane in any technical sense. He has no delusion. He does not act, or suppose himself to act, under an "influence." He simply wants to die, and, perhaps, not until after he has made an attempt to kill himself will he exhibit any of the formulated symptoms of mental disease.

A Frolicsome Arabian Stallion.

A suit was tried in one of our city courts the other day against Ulysses S. Grant, Jr., for injury done to the plaintiff (a Mr. Bailey) by a vicious horse. Some years ago Gen. Grant had presented to him a pair of Arabian stallions, which were being kept at his son's farm in Westchester County. One day one of the stallions was ridden to a store in the village, and hitched to a post. At this time Mr. Bailey was coming down the road in a two horse wagon loaded with eleven cans of milk.

Mr. Bailey, on the witness stand, told substantially the following story of what next happened: The young man who rode the horse had scarcely entered the store when the stallion threw up his head, pulled off the headstall, and started up the road. He came in contact with the complainant's horses, kicked and bit them, and crowded them into a ditch. The stallion then put his fore feet into the wagon, upset the milk cans, and then he leaped into the wagon like a dog and sat down in the complainant's lap. Then he kicked Mr. Bailey over backward, pawed him out of the wagon, jumped out, kicked over the wagon, tore the harness, and caused the witness' horses to run away. The horse then pawed the complainant in the face, broke a rib on the left side, injured his spine, badly bruising his shoulder, and left him unconscious upon the frozen ground. Mr. Bailey was assisted home, and has since been an invalid.

The defense was that U. S. Grant, Jr., did not own the horse; that he offered to settle all damages to wagon, horses, milk, and harness, and to pay Bailey's doctor bill, and that the offer was declined. The jury gave Bailey a verdict for $5,000.

THE attendance at some of the leading colleges for the current year is as follows: Michigan University stands at the head with 1,554 students; Harvard, 1,522; Columbia, 1,520, University of Pennsylvania, 1,044; Massachusetts Institute of Technology, 561; Princeton, 527. As regards the number of professors in each, however, the order will be somewhat changed. University of Michigan is omitted, owing to lack of data. Harvard has 32 professors, and a total of 55 instructors. Princeton comes next with 28 professors, and a total of 34, including tutors, etc. Yale, 20 professors, and total of 30 instructors. Columbia, 12, and total of 29.

Of these four last named, Harvard was founded in 1636; Yale, 1701; Princeton, 1746; Columbia (King's), 1754. Together with these statistics of number of students and professors, it would be interesting to note the sizes of libraries in the last named institutions. Harvard once more heads the list with a total of 277,700 volumes. Yale, total, 161,000 volumes. Princeton, 122,000 volumes. Columbia, 47,000 volumes. Harvard at present has 8 Fellows; Princeton, 8; Yale, 3; and Columbia, 2.

Blood Cake for Cattle.

The use of blood as a food for cattle has, it is stated, been the subject of experiment in Denmark by a chemist, who, as a result, has now invented and patented a new kind of cake, in which blood forms one of the chief ingredients. This new food is stated to be exceedingly nutritious and wholesome, and is eaten with avidity by all sorts of animals, and even by cows and horses, which have naturally a strong dislike to the smell of blood.

LIQUID CARBONIC ACID.--ITS INDUSTRIAL PRODUCTION AND USES.

The attention of the scientific world has been directed for a few years past to the curious researches of Messrs. Cailletet and Wroblewski upon the liquefaction of the last permanent gases that have, up till recently, resisted great pressures in the Thilorier apparatus for liquefying and then solidifying carbonic acid.

It would seem at first sight that such experiments could possess nothing more than a purely scientific interest, but the industrial applications of liquid carbonic acid that have just been made in Germany show that an experiment that is considered in the beginning only as a scientific curiosity may nevertheless become the starting point of industrial applications that are as singular as they are remarkable.

Messrs. Raydt and Kunheim, reproducing upon a large scale the apparatus which, during lectures on chemistry, serves to perform a certain number of experiments on liquid and gaseous carbonic acid, have, in fact, just patented an apparatus for the industrial storage of this gas in a liquid state.

This apparatus (Fig. 1) consists of a flask or strong iron tube, *a*, at each extremity of which are adjusted thick disks, *b* and *c*. The copper valve, *d*, is screwed into the upper end, *c*, and is closed by means of a threaded steel rod, *e*. During transportation the cap, *g*, is screwed upon the tube, *f*, and the whole mechanism of the valve is protected by the cover, *h*. In order to use the flask, the cover and cap are removed, and the vessel is then connected with the boiler by means of a coupling or a connecting tube. The apparatus is filled with pure liquid carbonic acid which has been produced and purified by well known processes, and which is compressed into the flask by means of powerful machines. Each flask holds about 8 kilogrammes of liquid carbonic acid, equivalent to 3,500 liters of the gaseous liquid at the ordinary pressure. Before being employed, the flasks are submitted to a pressure of 250 atmospheres, while liquid carbonic acid at 0° exerts a pressure of only 36 atmospheres, which rises to 74 by heating to 30°. As the pressure is constantly calm and regular all danger is averted, and the administration of the German railways has therefore, after a minute examination, concluded that it could authorize the sending of these flasks by all trains.

Up to the present time this liquid carbonic acid has been employed for the raising of beer in breweries, the access of air into the casks being thus prevented, as well as the acid fermentation that atmospheric germs might produce therein. Fig. 2 shows how the apparatus is set up. The liquid carbonic acid is contained in the forged iron cylinder, *a*, which is put in communication, through *i*, with an iron plate reservoir capable of easily supporting a pressure of from 4 to 5 atmospheres, and remaining in place in the brewery. In order to make a connection the lever, *c*, is raised, and this opens at the same time the two cocks, *c* and *d*, the first of which puts the cylinder in communication with the copper. This latter is connected through the second cock with the safety valve, *f*.

After this the cock, *h*, of the cylinder is opened by turning the key, *g*, to the left, the pressure gauge, *k*, being at the same time carefully watched. The acid, under a gaseous form, flows rapidly into the copper through the coupling tube, *i*, and in a few seconds the desired pressure of 1 or 2 atmospheres is reached, as may be easily seen from the pressure gauge. Then the valve, *h*, of the cylinder is closed by turning the key, *g*, to the right, and the two cocks, *d* and *e*, are closed by pushing down the lever, *c*.

Fig. 2 shows different modes of drawing. In cask I. the carbonic acid first traverses a collecting reservoir, *m*, designed for the reception of the small quantity of beer that might choke up the pipe through the differences in pressure between the cask and the reservoir, *b*; then it passes into the siphon, and forces the beer to the draught cock, *n*.

The arrangement of cask II. is more convenient. Here the carbonic acid makes its exit from the copper beneath the pressure gauge, *k*, flows first to the counter, and from thence is directed at will to cask II., through the cock, *o*. The pressure existing in this cask is ascertained from the gauge, *k*, and is regulated by means of the cock, *o*. The beer is drawn through the cock, *q*. In cask III. the carbonic acid passes anew through the beer reservoir, and the draught is effected directly through the siphon without conduit.

Finally, in the arrangement of cask IV. the siphon is likewise dispensed with. Here the carbonic acid reaches the beer through the bung hole, so that the beverage is drawn directly from the cask through the cock, *s*, without any pipe.

Aside from this special application, Mr. Raydt proposes the use of liquid carbonic acid for the manufacture of seltzer and other artificial mineral waters, etc., and, in a word, of all gaseous beverages. It is only necessary to introduce into

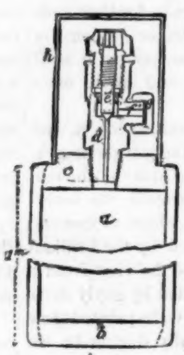


Fig. 1.—FLASK FOR LIQUID CARBONIC ACID.

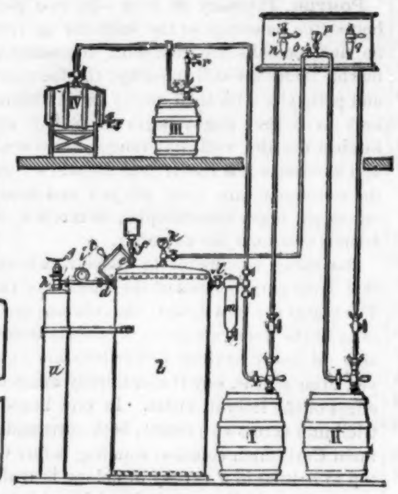


Fig. 2.—ARRANGEMENTS FOR RAISING BEER IN BREWERIES.

the liquids that it is desired to convert into aerated beverages the carbonic acid coming from the reservoir of liquid acid that we have described above. The inventors have likewise applied their apparatus to various kinds of extinguishers and fire pumps, which, in practice, have given most excellent results. Fig. 3 gives a general idea of a fire pump to which the system under consideration is applied,

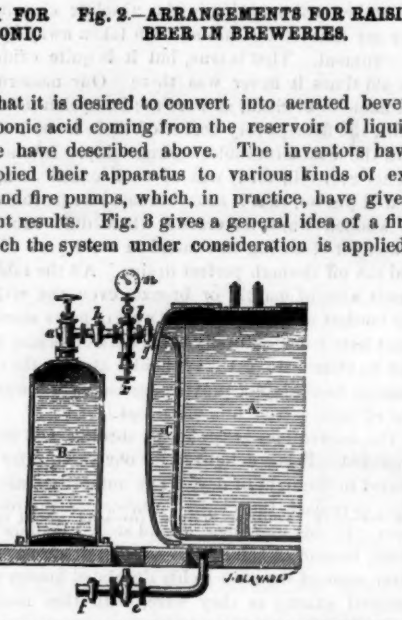


Fig. 4.—DETAILS OF MECHANISM FOR INTRODUCING THE CARBONIC ACID INTO A RESERVOIR OF WATER.

and Fig. 4 shows the details of the introduction of the carbonic acid into the receptacle filled with water, or a saline solution (phosphate of ammonia, boracic acid, etc.) more efficient than pure water. The acid passes from B to A through the intermedium of the tube, C, which is punctured with holes through which the gaseous acid escapes. At *b* there is a small hand wheel, *r*, which serves to regulate the pressure, and which is provided with a pressure gauge, *m*. When the acidulated water reaches the pressure determined by the regulator, *b*, it escapes through the cock, *e*, and may be directed horizontally or vertically in order to extinguish a fire. The gas may also be introduced directly into the boiler of a steam pump, so as to actuate the latter while the water is heating. Liquid carbonic acid has likewise received an interesting application in the production of compact castings. In this process, which is now in current use in the works of Mr. F. A. Krupp, at Essen, the mould is closed hermetically immediately after the metal is poured into it, and gas at a high pressure is made to enter it at the upper part by opening the valve of a liquid carbonic acid reservoir. In order to increase the pressure and make it regular, the carbonic acid reservoir is heated by means of a water bath. The pressure is exerted until no further tendency to form bubbles is shown in the molten metal. The experiments of Mr. Krupp have shown that in receptacles that are entirely full a heat of 200° produces the immense pressure of 1,200 atmospheres. The same process has likewise been applied with the greatest success at Bemdorff, near Vienna, in the production of compact castings of white metal.

Finally, the last application of liquid carbonic acid that has been proposed by Raydt is the use of it for raising sunken vessels. An application of air has for a long time been used for obtaining the same result, but carbonic acid has the advantage over the latter in that it requires the use of no costly apparatus, difficult to actuate. In some experiments made in the port of Kiel a stone weighing 300 quintals, and sunk to a depth of 10 meters, was raised to the surface in eight minutes by means of a bag inflated with carbonic acid.—*La Nature.*

Fig. 3.—A FIRE PUMP OPERATED BY LIQUID CARBONIC ACID.

The Value of Exhaust Steam for Heating Purposes.

When standing on a tall building in New York city, in the winter time, one cannot help noticing the number of exhaust pipes from steam engines which puff their heat and vapor into our atmosphere.

How few of the many who thus view the great city from on high, and are driven into a reverie over the thousands of busy people who are beneath, and the industries that these little white puffs are a waste product from, have any idea of the thermal value represented in these apparently useless clouds!

This steam, when it leaves the top of the exhaust pipe and before it is condensed or dissipated in the atmosphere, represents, we can safely say, three-quarters of the actual value of the coal that was used in the furnace to produce it. Less than one-tenth of the energy of the fluid has been realized in the engine, yet it is all that can be so utilized. What has been used in the engine we may call the static energy of the steam, and what is going to waste in the atmosphere is the potential energy. The static energy is about 1,980,000 foot-pounds per horse power per hour, but the potential energy, according to the steam used for average engines, is about 30,000,000 foot-pounds for the same time.

It may appear incredible to the business man that a residuum so valuable should be let run to waste if it is possible to utilize it, but nevertheless such is the rule in New York at the present time.

To scientific engineers its value has been long known, and the utilization of exhaust steam for warming air, etc., has long and successfully been practiced in some industries, and in warming workshops and factories, but its use in large buildings in New York is of comparatively recent date, and very few are as yet using it, or can be induced to try the experiment, because of the prejudice of some of their engineers. There are buildings where its use has not been a practical success, but that was because the arrangements were not planned by a competent person.

In summer time this heat must be wasted, but in winter it should be used for warming and cooking. Many of our buildings as they are now piped cannot use exhaust steam successfully, but successful methods can be devised by any competent steam heating engineer, and we hope in a few years to see architects and owners fully educated and alive to the importance of preventing the waste that takes place from the top of our exhaust pipes. —*Sanitary Engineer.*

Layering a Rose Bush.

A writer in one of our agricultural newspapers says that a rose bush may be layered with little trouble, and then tells how to do it. Make a narrow trench, three or four inches deep, where a good well grown shoot can be bent into it. After blooming, in June, cut a slit in the shoot selected at the point where it will touch the soil, press some soil into the cut, bend the cane down to the bottom of the trench, and fasten it there with some pegs, and cover it well with soil. By fall it will be a rooted plant, and can be cut away and transplanted

DEEP SEA FISHES.

The marine explorations that have been made during the last few years by American, English, and French expeditions have shown that the deep sea fauna is wonderfully rich in strange forms of fishes, and it is now known that no less than twenty-eight families of these animals are confined entirely to great depths, or are represented elsewhere by mere stragglers. Three new family types were obtained last year. As regards orders, two, the Lyomeri and the Cavencheli, are only known from deep sea representatives.

The fact that fishes which live permanently at great depths exhibit certain peculiarities of form should not surprise us, when we consider that the structure of these animals has to suffer important modifications before being adapted to these peculiar conditions of life. Various influences act upon these fishes. Light and vegetation are wanting, and, beyond a certain depth, the temperature tends to become equalized, and the water is always calm. The modifications due to such conditions relate to the structure of the tissues, the size of the eyes, the development of the sense of touch, and to coloration. Moreover, these fish have organs that are not possessed by ordinary animals of their class, and the function of which is to emit a phosphorescent light, and to thus make up for the light of day, which does not reach them.

The changes that the tissues have undergone are seen in the structure of the skin, muscles, and bones. The skin is thin and lacking in bright colors, the shades varying from grayish to a velvety black. The scales, which are often much reduced in size, are so slightly attached that even the friction that they experience during the ascent of the trawl serves to remove almost all of them. The muscles are flabby, and, having no flavor, are not edible.

Contrary to what we should expect, the eyes of fishes living continuously at great depths are of normal size, and are peculiar in neither position nor structure. This is not the case with those species that live at depths to which a little light penetrates, for in these the eyes are quite large in order to present a larger sensitive surface. The phenomenon is explained when we consider that, as above stated, these deep sea species have the faculty of emitting a phosphorescence that lights up a considerable space about them and serves to guide them.

Fishes living at great depths seem to move but little, and evidently lie buried in the mud. It often happens that several fin rays, instead of performing the ordinary functions of such appendages, become converted into organs of touch. One of the most remarkable examples of this is shown by a fish captured at a depth of 13,120 feet, in the Talisman expedition off the coast of Africa, the *Melanocetus Johnsoni* (Fig. 1). In this fish, which was till then known only from a single specimen that was found floating on the surface near Madeira, the first ray of the dorsal fin is developed and forms a genuine organ of touch, answering the same purpose as the one possessed by the goose fish. In this latter also there is a tentacle at the extremity of the first ray of the dorsal fin. The goose fish lives in the sand or mud, where by means of its fins it makes a cavity in which it buries itself so as to allow only the upper part of its body to project. The tentacle, which is ever in motion, serves as a bait to attract prey. The Talisman's collection embraced other various fishes that exhibited similar transformations of the fin rays into tactile organs.

All fishes that live continuously at a depth greater than 2,000 feet are carnivorous. This results from the fact that, owing to the absence of light, vegetation gradually disappears as we descend, and, consequently, all species of fish that do not ascend to within five hundred feet of the surface (the point at which the last algæ are found) are obliged to hunt for animal food. Fig. 2 shows one of these species, *Macrurus australis*, which was taken by the Talisman expedition at a depth of 14,740 feet. One of the most remarkable features of fishes living at these great depths is the great development of the mouth and the stomach, as may be seen in the species that we represent in Fig. 1, and of which we have already spoken. In this fish, *Melanocetus*, the capacity of the stomach is such that it is capable of holding prey whose size is double that of the fish's own body.

One of the most interesting questions concerning the distribution of fish relates to the maximum depth at which these animals are met with. During the cruise of the Talisman the fish caught at the greatest depth was the one above noted—*Macrurus australis* (14,740 feet). The Challenger expedition took a fish (*Bathyophis ferox*) at a depth of 16,460 feet.

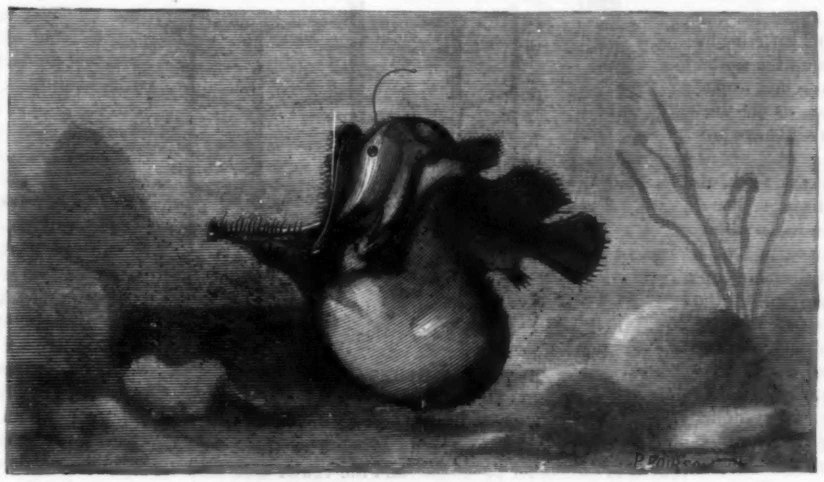


Fig. 1.—MELANOCETUS JOHNSONI.

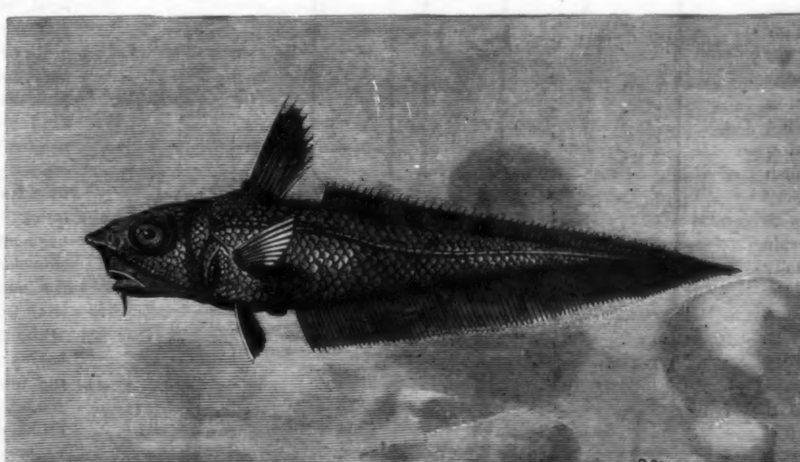


Fig. 2.—MACRURUS AUSTRALIS.

CAPT. ELIJAH RAYNOR, of the Ranger, of Greenport, caught off Fire Island lately 1,200,000 menhaden.

Notes on Earthworms.*

Ever since our great naturalist called attention to the common earthworm, we watch them with entirely different eyes as they creep timidly out on to the lawn or hurry across the gravel walk; as they collect the dead leaves or bits of string and cloth we may have dropped the evening before, or heap up their household refuse outside the entrance to their home.

He long ago pointed out its importance as a geological agent. The surface of the ground would be very different were it not that the earthworm is for ever at work bringing in the decaying vegetation and converting it into mould. And, more than this, the superficial deposits are often modified to a considerable depth by the earthworms, which, carrying the earth mouthful by mouthful, and the gravel stone by stone, invert the order of stratification.

But we must not push this explanation of the origin of the universal surface mould too far. I received one caution from Darwin himself many years ago when I was talking to him about the manner in which the chalk with which the land was dressed in Kent worked down. He told me to be careful to bear in mind the action of the great Kentish plow as it year by year turned swath after swath down the slopes. The result of this plow down is clearly distinguishable from worm mould. In his work on earthworms also he refers to another mould forming agent of more universal operation and hardly less important cumulative effect. My attention was first directed to it by a lecture I heard delivered by Stoppani in Milan many years ago, in which he was explaining the action of the wind in modifying the surface of the earth, and especially in carrying dust, organic and inorganic. Richthofen and Drew have thus explained the origin of the loam that covers half Asia; and Mr. Clement Reid has recently extended the same kind of observation to Great Britain (*Geol. Mag.*, April, 1884). Without this addition we can hardly explain how earthworms could find the material for the manufacture of the mould which often fills the interstices of the ruins of a buried city.

We find, commonly, isolated tumps of moss covered soil, and every gradation from that up to the large patches of mould which hang like little gardens on each sheltered ledge, where the greater part of the material must evidently have been carried from elsewhere and not have been brought up from below; where it is obvious, from the character of the rocks, that the principal part of the mould cannot have been derived so much from them as from the wind carried fragments of organic and inorganic material and the decomposition of the vegetation that soon began to grow upon it.

But we find also that the earthworms soon appear in such places, and set to work to mix up and modify all this various stuff that has by various agencies been brought together.

As squirrels, burying acorns and nuts in the autumn, have planted many an oak forest and hazel grove, so it is probable that the earthworms plant many of the ash and sycamore trees that we see perched in out-of-the-way corners, where it is difficult to explain how the blown seed can have got covered by mould enough to allow it to germinate. If an overhanging tree drops the seed, or the wind carries it anywhere near the worm's feeding ground, it is dragged in and planted in leaf mould, and kept moist till spring time. At this time of the year we see clusters of sycamore seedlings growing up together out of the little worm hills into which they had been dragged heavy end first.

It is therefore interesting to inquire into the various reasons that should make earthworms travel and occupy new ground. Round the margin of an overcrowded colony we should expect them to spread. They cannot live under water, so they have to move away before a flood. It has been stated that "they may live when completely submerged in water for nearly four months" (Romanes reviewing Darwin, *Nature*, vol xxiv., p. 553). But they were killed off by a flood of a couple of days' duration in the backs of the Colleges of Cambridge in August, 1879. Some of them seem to have got on to the paths, which are raised above the surrounding meadows, and there died. Where the greatest number were found dead the ground had been submerged for a longer time. The following carefully recorded observations by the Rev. Henry Russell, of St. John's College, are worth noting:

"On Sunday, August 3, 1879, our paddock (the inclosed space in which the men play at lawn tennis, in front of the new court) was covered with water to the depth, at 1 P.M., when it was greatest, of four to five feet. The level of the paddock is much lower than that of the ground surrounding it. . . . Therefore, on Wednesday, August 6, I cut a trench from the northwest angle of the paddock across the raised path. . . . The water had drained off by Saturday evening, August 9. The rush of water from the west across the Fellows' garden had carried with it into the paddock a great quantity of worms, which, when the water had subsided, were observed, some very large, lying dead under the water. As the water drained off, these lay on the paddock and on the slopes of grass surrounding it, and the smell of them infected the air till Friday, August 15."

Mr. Russell's observations go to show that the worms found dead were not all worms that had lived in the paddock, but those which had got washed out with the earth from the Fellows' gardens, and so they perhaps perished sooner being in the water. It is probable that worms buried deep in the earth under submerged meadows may, if they remain underground, hold out through much longer floods. However, I gather that a large number perished in the adjoining parts of the backs, and were seen on the paths and slopes as soon as the flood began to subside. Many of them were of exceptionally large size. I have heard of land injured by floods where the injury was supposed to be principally due to the destruction of all the earthworms. It is probable that the growth of peat mosses may be in great part referred to the fact that the conditions were unfavorable to earthworms, for had they been there they would have worked up the vegetable matter into mould.

But there must be something besides floods that makes earthworms migrate.

If we drive a stick into the earth and move it about so as to shake the ground, the earthworms will come out to the surface and scuttle away in all directions. This was a common way of getting worms for fishing, and we used to be told, as Darwin notices, that the worms came out because they thought a mole was digging after them.

There must be, however, some other reason why worms will often come out to the surface in the daytime, and hurry away across a gravel path or on to a road, and why they then seem so much less sensitive to tremor of the ground about them than do the worms that come out to feed on the lawn.

From the analogy of other more highly organized animals I could not help thinking that there must be some creature that hunted the common earthworm, some worm ferret that drove them out. Many who have passed their lives in the country know well when they see a large field mouse cantering down a road and showing little fear of man that a fiercer enemy than man is following the poor little animal with untiring certainty. If you draw aside and watch, you will soon see a weazel following by scent. Even a hare or rabbit will at length lie down paralyzed with terror, and give itself up to the stoat that has followed it with deadly pertinacity. The sudden appearance of one or two strange birds in a neighborhood has often been a source of wonderment, and it has sometimes been suggested in explanation that they had been chased by birds of prey and got up into strong currents of air. Those who have seen a peregrine drive a

* T. McKenny Hughes, in *Nature*.

flight of rooks up into the sky can easily see how this might happen. In the cases to which I am referring, the earthworm comes out like a hunted thing. I have also noticed that many of the worms that I found dead or torpid were maimed; generally they had their tail cut off, and this when there had been no digging in my garden for a long time, and although there are few birds that would touch them. I have frequently observed that the earthworms were apparently unwilling to go to ground again, though I have tried to make them, in order to watch the rate and manner in which they bury themselves.

A few days ago, however, I saw, I believe, the explanation of most of the cases I had been observing. A large earthworm about nine inches long, bright, clean, and healthy looking, was moving somewhat irregularly on the earth of a flower bed. On stooping to examine it, I found a small yellow animal with a brown head holding on within about half an inch of the tail end of the worm. I sent it to Prof. Westwood, who writes: "Your worm eating larva is evidently one of the Carabidæ, probably *Steropus madidus*" (see *Gardeners' Chronicle*, 1854, p. 613). It was not disturbed by my taking up the worm, but went on biting its way round the worm, holding on like a bull dog, and bettering its hold every now and then. It had nearly got round the worm, leaving a lacerated ring. The wounded part seemed somewhat swollen, but on this point I am not clear, as the unequal power of extension of the wounded part may have produced the effect of swelling.

Mr. Edwin Laurence has recorded (*Nature*, vol. xxvi., p. 549) a similar circumstance observed by him in France, where, however, the larva seems to have attacked the worm differently, and with a view to killing it rather than cutting off a portion, and from his description, moreover, it would not appear to be the larva of the same species. He suggests that the numerous birds in England may have destroyed such an enemy of the earthworm. A sparrow would probably take the larva, and not touch the earthworm. One would have thought that the earthworm would have a better chance of rubbing off his deadly enemy in the earth than above ground, as a salmon is said to clean himself in a gravelly river, but we want further observations on this curious question, as well as on several others raised by the inquiry, How are worms transported to out-of-the-way places? and, How long can they live in soils of various degrees of permeability when the surface is flooded?

Consumption of Railway Ties.

There are now fully 148,000 miles of railroad *track* in the United States, and therefore about 391,000,000 ties, and the average consumption for renewals should be about 56,000,000, or the product of 560,000 acres of land, at 100 ties per acre, requiring 126,800,000 acres = 26,000 square miles, equal to less than half the area of Michigan or Wisconsin, two-thirds the area of Maine, and a little more than half the area of North Carolina, if, as reported, it takes 30 years to grow tie timber.

Mr. Hicks says that the reports to the Forestry Department show that it takes an average of 30 years to grow timber large enough for ties, and that the product is about 100 ties per acre, while the average cost of ties to the railroads is 35 cents. This is a product worth $35, as the return of an acre for 30 years. If this is all, then with money at 5 per cent, no cost of cultivation and no taxes, it will pay to grow ties on land already wooded worth $8 per acre, and on land worth $7 per acre if interest is 6 per cent.

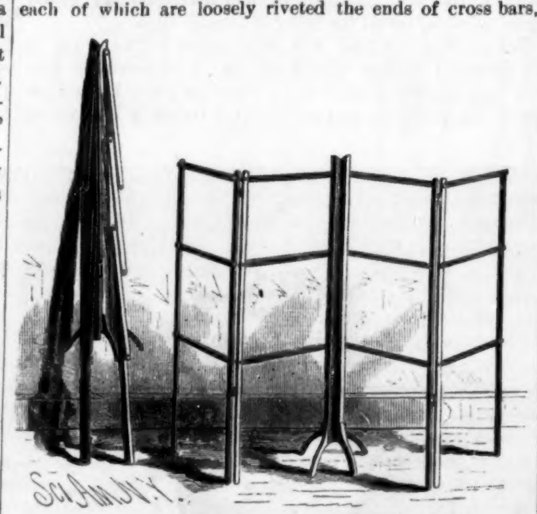
If 113·3 acres of woodland are required to maintain the ties of every mile of railroad, the question with the railroads, says the *Railroad Gazette*, is not simply whether they should produce their own ties, but also whether they may not profitably diminish their consumption. The experience of Germany indicates that an average life nearly three times as long can be had by preserving the ties with chloride of zinc, or creosoting (so called, for there is usually little or no creosote in the oil used). But even if the product of 56 acres per mile is required, it does not follow that the only escape from a famine will be the cultivation of timber. If land planted or stocked naturally with the trees which will make 100 ties in 30 years is worth $20 an acre—and in many parts of the country it is worth as much as that—at the end of the 30 years required to grow the trees it will represent, with interest at 6 per cent, $118, and with interest at 5 per cent, $88; and if then the land after the ties are cut is still worth $20 an acre, the 100 ties, before cutting, will have cost $98 in the one case and $68 in the other. But the taxes meanwhile would probably have cost $50 or $60 more, and there would be some expenditure for care. If then the land is not cheaper than $20 per acre, the railroad will probably do better to depend upon some metallic substitute than to grow tie timber, even if it gets 14 years' life out of a tie.

Better to Wear Out than Rust.

The late Prof. Samuel D. Gross at a dinner given to him in Philadelphia on April 10, 1879, said: "After fifty years of earnest work I find myself still in the harness; but although I have reached that age when most men, tired of the cares of life, seek repose in retirement and abandon themselves to the study of religion, the claims of friendship, or the contemplation of philosophy, my conviction has always been that it is far better for a man to wear out than to rust out. Brain work, study, and persistent application have been a great comfort to me, as well as a great help; they have enhanced the enjoyment of daily life, and added largely to the pleasures of the lecture room and of authorship; indeed, they will always, I am sure, if wisely regulated, be conducive both to health and longevity. A man who abandons himself to a life of inactivity, after having always been accustomed to work, is practically dead."

CLOTHES HORSE.

The engraving shows an improved clothes horse, for which latters patent have been applied for by Mr. M. F. Blake, of Martinsburg, Pa. Each frame consists of two side bars, to each of which are loosely riveted the ends of cross bars,



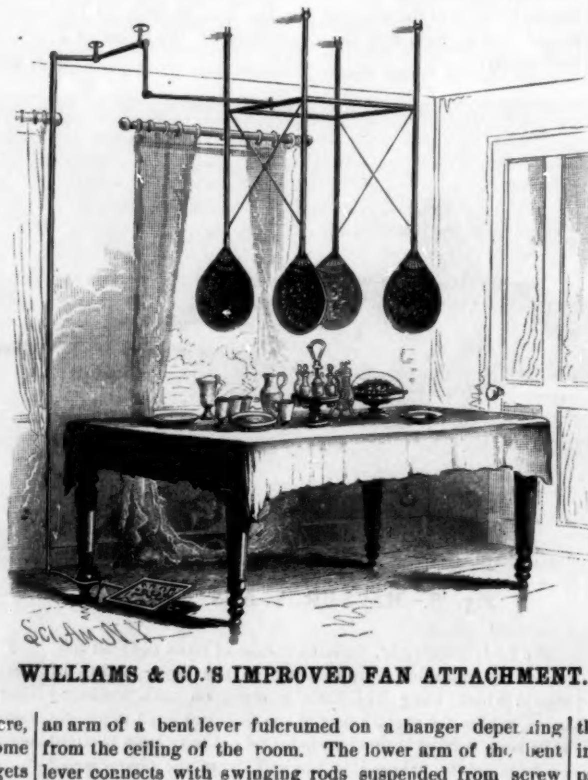
BLAKE'S CLOTHES HORSE.

this construction permitting the frame to be folded so that the side bars will rest side by side. The frames are secured to each other by hinges, and the center side bars are provided with branching legs—shown clearly in the right hand view—upon which the device will stand when so folded up that the other side bars will not extend below the center ones. The device may also be folded up as shown in the left of the engraving.

Made in this manner the clothes horse is cheap and durable, and when extended can be made to assume almost any desired position, and when folded occupies but little space. When closed, the center bars are held together by a hook and eye.

IMPROVED FAN ATTACHMENT.

The fan attachment shown in the accompanying engraving is the invention of, and is now being manufactured by, Messrs. A. O. Williams & Co., of Nos. 5 & 7 College St., Nashville, Tenn. A treadle is attached to one end of a lever, from the other end of which a rod extends upward and unites with



WILLIAMS & CO.'S IMPROVED FAN ATTACHMENT.

an arm of a bent lever fulcrumed on a hanger depending from the ceiling of the room. The lower arm of the bent lever connects with swinging rods suspended from screw eyes made fast in the ceiling. These rods are connected by horizontal bars from which the fans hang—the joints being loose so that the fans, which are rigidly secured, may move freely in a horizontal plane. By placing a foot upon the treadle, any one sitting at the table can transmit motion to the fans through their connections, so that flies will be driven away and the air agreeably moved. The device is simple, cheap, and easily set up and operated, and by its use in warm weather the pleasure and comfort of those at the table can be greatly augmented.

Glass from Bradford Rocks.

It was practically demonstrated yesterday afternoon (May 19) that the manufacture of glass from Bradford sand rock through the agency of natural gas is entirely feasible, and our initial glass industry must prove an opening wedge to kindred enterprises which must redound to its credit. A curious crowd gathered at the works yesterday and watched the blowers skillfully gather the molten bolts of glass from the pots and blow huge cylinders, which after passing through the annealing oven will as sheets be cut into window panes. Of course, on a "first performance" of this kind there are numerous little details to be arranged, and it is difficult to speak advisedly of the full measure of success achieved, but its result is regarded as highly satisfactory. In a few days everything will probably be working smoothly, and visitors will see much to interest them. Superintendent McCartney and a number of glass blowers, with several samples of the work in the shape of globes, cylinders, and canes, marched to the Riddle House and received the congratulations of the crowd. Thirty carloads of window glass have already been ordered from the Bradford glass works, and this may be considered as merely an earnest of what will be required should reasonable expectations be realized. The first product of the works will be used in the windows of the buildings. An eight-pot furnace is now in operation, and the ground is laid out for another of the same capacity. The gas fuel works splendidly, producing a most intense heat and fulfilling every requirement.—*Pittsburg Era.*

Goods Duty Free into Mexico.

Under the new reciprocity treaty between the United States and Mexico, the articles enumerated below are to be admitted free of duty into Mexico:

Accordions and harmonicas; anvils; asbestos, for roofs; agricultural knives, without their sheaths; anchors, for vessels, large or small; apparatus of all kinds for industrial, agricultural, and mining purposes, sciences and arts, and any extra separate parts and pieces pertaining thereto; bars of steel for mines, round or octagonal; barrows and hand trucks, with one or two wheels; bricks of all kinds; books, printed, unbound or bound in whole or part, with cloth or paper; beams, small, and rafters for iron roofs; barbed wire for fences, and the hooks and nails to fasten the same; coal, of all kinds; cars and carts, with springs, two wheels, four wheels, small hand; coaches and cars for railways; crucibles and melting pots of all materials and sizes; cane knives; clocks, mantel or wall, fine and ordinary; carriages and diligences of all kinds and dimensions; dynamite; fire engines; fire pumps; faucets; fuse and wicks for mines; feed, dry, and straw; fruits, fresh; firewood; guano; hoes, mattocks, and their handles; houses of wood and iron complete; harrows; henequen bags, on condition that they be used for subsequent importation with Mexican products; ice; iron and steel, made into railways; instruments, scientific; ink, printing; iron, beams; instruments of iron, brass, or wood, or composed of these materials, for artisans; lime; locomotives; lithographic stones; masts for vessels; marble, in blocks; marble, in flags for pavements, not exceeding 40 centimeters in square, polished only on one side; machines of all kinds for industrial, agricultural, and mining purposes, sciences and arts, and any separate extra parts and pieces pertaining thereto; metals, precious, in bullion or in powder; money, legal, of silver and gold of the United States; moulds and patterns of the arts; naphtha; oats, in grain or straw; oars, for small vessels; pumps, ordinary, for irrigation purposes; pickaxes; plows and plowshares; paper, tarred, for roofs; plants of any kind not growing in the country, for cultivation; pens of any metal, not silver or gold; petroleum, crude; petroleum or coal oil and its products, for illuminating purposes; powder, common, for mines; quicksilver; rakes; rags or cloth for the manufacture of paper; roof tiles of clay or other material; sickles; shovels; spades; seeds, of any kind not growing in the country, for cultivation; sulphur; stoves, of iron, for cooking and other purposes, with and without ornaments of brass; staves and headings for barrels; steam engines; soda, hydrosulphate; sewing machines; slates, for roofs and pavements; sausages, large or small; teasels of wire, mounted on bands for machinery, or vegetable teasels; types, coats of arms, spaces, rules, vignettes, and accessories for printing of all kinds; vegetables, fresh; wire, telegraph, the destination of which will be proved at the respective custom houses by the parties interested; wire of iron or steel for carding, from No. 26 upward; water pipes of all classes, materials, and dimensions, not considered as comprehended among them tubes of copper or other metal that do not come closed or soldered with seam or with riveting in all their lengths; window blinds, painted or not painted.

Fast Speed Telegraphy.

Speaking of a recent contest among Morse operators in London, the *New York Operator* says: "We are willing to admit that England can produce as fast operators as we can, but we claim that with their lumbering code of signals as against our rattling combination we can beat them, everything else being equal. We have sworn records of fast Morse sending at the rate of forty-two words a minute for sixty consecutive minutes—over 2,500 words in one hour.

Weston's Walk of Five Thousand Miles in One Hundred Days.

Since March 18, 1884, I have had the opportunity of making two careful physical examinations of Mr. Edward Payson Weston, who between the hours of nine and ten o'clock on Saturday evening, March 15, 1884, completed at the Victoria Coffee Hall, near Waterloo Railway Station, London, the very remarkable feat of walking five thousand miles in one hunded days. The walk thus accomplished was carried on partly out of doors on common roads, and partly on covered tracks; part, that is to say, up hill and down dale in all weathers belonging to the months of November, December, January, February, and of March, and part on a level plain, under shelter. The out-door walking was, of course, most exposed and most laborious, but the indoor was not without its drawbacks, the chief of which was the shortness of the laps. In one track the laps were thirty-six to the mile, and made the pedestrian so giddy at the first start that he was brought nearly to a standstill. At night, also, after a day of these short laps, he continued to suffer. He experienced a sensation as if he were turning a somersault forward, just as he was going off to sleep, a phenomenon which would recur several times before he was fairly rocked into sleep. The impression on the nervous system was much like the impression of the motion of a vessel at sea on some persons after landing from a voyage.

During the effort Mr. Weston rested regularly each Sunday and on Christmas day. He did this from a desire not to cause objection to be felt respecting his task, rather than from any necessity for the rest itself. On the contrary, he would, as a matter of exercise, have preferred to have continued at his task, and have finished eighteen days sooner. The Sunday rest affected him little on the following Monday, but on the succeeding Tuesday morning it caused each time a drowsiness which impeded him more or less through out the whole of the day, and which he attributes to the circumstance that he did not get his usual sound sleep on Sunday night. In the entire walk Mr. Weston made nearly 11,000,000 steps. He averaged three and a half miles to four miles an hour. He generally rested from two to three hours during the day, but not always. On the last day he walked from Brighton to London, fifty-three miles, without resting at all; he did not even sit down, but took food and drink as he went along. He finished each day's walk by delivering a lecture, and at the close of his feat he seemed to be as fresh and vigorous as ever.

In so far as current means of diagnosis assist us, Mr. Weston stands before us a specimen of a man of as good a standard of health as we could expect to see. I do not remember ever before to have devoted so much time to the exhaustive diagnosis of any one healthy person; but tedious as the labor has been I do not regret it, since it has given me, and I hope may give others, a few hints for a mode of arriving at a standard of vital measurements. A set of standards of such measurements being supplied, we ought, by the application of the exclusive method, to make diagnosis an art of absolute certainty in most cases of disease. In the matter of diagnosis Mr. Weston has afforded ground for useful observation. But it is to physiology that he has been most useful as a subject for experiment. In this direction he gave Dr. Flint, and Dr. Flint's learned colleagues, the opportunity of bringing out, in 1870, the best report in any language on the vexed question whether, during muscular exercise, the muscular substance itself is consumed, and whether there is indication of such consumption being indicated by the increased elimination of nitrogen by the urine; or whether, during muscular exercise, it is only the fats and non-nitrogenous foods that are consumed, and that the excess of nitrogen is due to the amount of nitrogen taken in as food, not to actual consumption of the muscular fiber itself. How far this most important question is further answered by the results of Mr. Weston's latest pedestrian feats I leave for a future study; but there is one physiological truth which I must note as I conclude, namely, that the healthy condition which he represents after one of the severest physical trials on record affords the most decisive of proofs of the success of meeting physical work on good diet—sans wine, sans beer, sans grog, sans everything of the sort.—*Asclepiad.*

Determination of Cream in Milk.

The present method is a very troublesome one, and occupies considerable time. In the last meeting of the Society for Natural Philosophy in Frankfort-on-Main, Dr. Lepsius described Foxhlet's new method, which is as follows: A potash solution is added to the milk, and the latter then shaken with ether. With fine aerometers the percentage of fat can be then easily determined in the ether. It is said that while this method permits the same accuracy as the old one, it has the great advantage of great rapidity. In the same meeting the subject of the value of skimmed milk as a nutritive substance was also debated. It was generally admitted that on account of its cheap price and percentage of albuminous material—this not being at all diminished by the removal of the cream—skimmed milk is of great value, especially for the poorer classes. At the same time it was shown that milk with the cream left in it, but diluted with water, loses in value as a nutritive substance, as the same percentage of albumen is no longer contained in the fraudulent fluid. They all agreed that substances of such common use as milk should be daily inspected by a government official, and any fraudulent admixture be made widely known.

THE STEAMER AMERICA.

A new and splendid Atlantic steamer, built of steel, named the America, arrived at this port on the 5th of June, after the very rapid passage of a little more than 6¼ days from Queenstown. The ship belongs to the National Line, between New York and Liverpool. On this, her first voyage, she averaged a velocity of over 18 miles an hour for six consecutive days, and on one of the days made 477 miles, being 20 miles an hour for the day, less 3 miles. The probability is she will improve on this speed; a very little improvement will place her at the head of the class of fastest steamers.

The America is 450 feet long, 51¼ feet beam, 36 feet depth. Engines three cylinder compound, one 63 inches, and two of 91 inches; stroke 66 inches. Piston valves on all the cylinders. Seven boilers and 39 furnaces. Working steam pressure, 95 pounds; 9,000 developed horse power. This ship is built specially for speed and passenger service. Her accommodations are superb.

The only steamer that has exceeded the speed of the America is the Cunarder Oregon, which made the passage in 6 days 10 hours and 10 minutes. The general public looks chiefly to the speed attained, but shipowners will be interested to know that although the Oregon arrived in five hours and a half less time, her consumption of coal was 337 tons each day, while the America burned only 190, a difference of 147 tons a day. The Oregon carried 120 engineers, firemen, and coal heavers, while the America required but 92. The difference of expense in the engine room alone is not far from $450 a day while under steam, $3,150 for each passage, and $75,600 for a year. The Oregon developed about 16,000 horse power, while the America developed less than 9,000. These figures show conclusively that the speed of the America is due entirely to her model. She is the first ship that has been built on a model looking to the passenger traffic almost exclusively for profit.

She has twelve bulkheads so arranged that she could float even if two compartments were filled by a collision. Her chief engineer is of the opinion that she would still float after her engine room has been filled by a collision. She carries 10 large life boats. The America is commanded by Capt. R. W. Grace. Mr. William Dover is chief engineer. The America carries 32 seamen in her forecastle, 92 men all told in her engine room, and 82 cooks and stewards.

The National Line has carried about 1,000,000 passengers across the Atlantic since it was organized, and has never lost a life.

Action of Light on Colors Employed for Dyeing.*

Matters relating to the phenomena which can be classed under the above heading have for a long time engaged the attention of practical men, artists, and a few scientists, and various methods of trial have been proposed for the classification, as to stability, of the colors employed in dyeing. Former State regulations, forbidding under more or less severe penalties the employment of certain of these coloring matters, have to some extent split up the substances in question into two great classes, namely, the fast and the loose, or the stable and the unstable respectively, from whichever point of view we may regard the matter. It was especially forbidden to dyers to use indiscriminately coloring matters of these two classes in the carrying out of work entrusted to them.

The investigations of Dufay and Hellot on the resistance of dyed goods to washing, etc., were certainly of great service in aiding the establishment of a proper adjustment of the two classes of dyewares, but soon the State regulations were no longer enforced, and with them vanished the check to careless work, which, although a rather awkward restriction to the dyeing trade, still did good in keeping down the production of worthless goods. The action of daylight on dyed goods was the first thing to be ascertained when experimenting on stability and resistance to altering agents in general. As is well known, the desideratum is the maximum amount of resistance to atmospheric influences, to day or sun light, to air, water, and finally soaping in many cases. Besides this, the goods require, in order to satisfy just demands made as to their power of serving, to be dyed in colors varying in intensity, brightness, and solidity, according to the different uses to which they are to be put.

Thus tissues intended for preparing artificial flowers, also those for ladies' ball and evening costumes, do not require to be exposed to much else than artificial light, and hence can be dyed with fugitive colors and in light shades. On the other hand, summer goods in the same lines ought not to be got up with any but colors stable with respect to sunlight. These may be of shades light enough to be but little altered by slight changes, but the time during which they are to be used and the price of the cloth on which they are dyed must fix the stability the colors are required to possess. The same may be said of the dyes employed for men's clothing, only, as a rule, intensity of color is not essential nor demanded, except for military purposes and for furniture goods. Furniture goods, such as cretonnes, etc., require to be dyed in colors possessing intensity and fullness of shade, together with the maximum amount of resistance to the influence of light, especially as a considerable quantity of the above mentioned goods is of a very high price, and hence requires to serve for a long time.

To-day the classification of colors in an accurate and practically available manner, with reference to resisting power, etc., is all the more essential to the dyeing trade, as it is now fast becoming the practice to employ the so-called aniline colors, not only for artificial flowers and goods of a similar class, but also for dress goods for both men and women, and for furniture. Reference may here be made to the fact that the splendid bouquet of roses got up with anilines, and exhibited at the International Exhibition in 1878, in a few weeks was modified to a livid shade by the diffused daylight. It was evidently very necessary to devise a quick and ready method of experiment, and, above all, one giving constant results. We arranged series of woolen samples dyed in different colors of the same intensity, and considered stable together, and parallel with series of similar samples and color, but of unstable character. An opaque screen was cut off one-half of each sample, and these series were exposed to the action of daylight and sunlight, under the protection of a thin glass, during one summer month. As the result of this exposure, we observed an enormous difference in the resisting power of different colors, and this difference was rendered the more striking by comparing the unaltered portion, which had been covered by the opaque screen, with the exposed and altered portion.

All, indeed, were modified to a certain extent—small, indeed, in some cases—but it was obvious that the majority of the colors obtained by the old systems, such as vat blues, Prussian or royal blues, cochineal, madder, wood colors, etc., were much more stable than Nicholson blue, fuchsine, picric acid yellow, etc. However, there is one exceedingly remarkable thing to be noticed in comparing the results obtained on one series of twenty-four samples, and that is that four of the artificial organic coloring matters stand by themselves in forming a distinct and separate class remarkable for the resisting power of its members. The four colors in question are the following: (1) The Ponceau, called "Carmin de Naphthol, coming in Class II. Red. (2) An Orange, marked II., coming in Class IV. Orange Red. (3) Chrysoine, placed under Class II. Orange. (4) Artificial Alizarine, which has, in the present state of the dyeing trade, almost driven out madder, and is much more stable than the so famous ancient article. The class numbers attached refer to the chromatic scale of colors devised by the eminent scientist Chevreul.

A copy of this scale is to be found in every Continental dye and print works, and renders service in combining and matching tints which it is not easy to overestimate. By their beauty, and their fastness and stability on wool, these four colors encourage us in the hope that chemistry will continue to render eminent services to the dyeing trade, and may finally succeed in producing whole series of colors, fast and stable, as well as beautiful and brilliant. As the power of resisting modifying agents possessed by coloring matters depends to a large extent on the methods employed in their manufacture, we may state that the colors used were presented by Messrs. Poirrier and Company, of St. Denis (Paris), in whose works they were all prepared, under the skillful superintendence of Monsieur Rosenstiehl.

* By Mons. Decaux, manager of the Gobelins, Paris.

The Laboratory that Jack Built.

This is the laboratory that Jack built.

This is the window in the laboratory that Jack built.

This is the glass that lighted the window in the laboratory that Jack built.

This is the sand used in making the glass that lighted the window in the laboratory that Jack built.

This is the soda that, melted with sand, compounded the glass that lighted the window in the laboratory that Jack built.

This is the salt, a molecule new, that furnished the soda that, melted with sand, compounded the glass that lighted the window in the laboratory that Jack built.

This is the chlorine, of yellowish hue, contained in the salt, a molecule new, that furnished the soda that, melted with sand, compounded the glass that lighted the window in the laboratory that Jack built.

This is the sodium, light and free, that united with chlorine, of yellowish hue, to form common salt, a molecule new, that furnished the soda that, melted with sand, compounded the glass that lighted the window in the laboratory that Jack built.

This is the atom that weighs twenty-three, consisting of sodium so light and free, that united with chlorine, of yellowish hue, to form common salt, a molecule new, that furnished the soda that, melted with sand, compounded the glass that lighted the window in the laboratory that Jack built.

This is the science of chemistry that teaches of atoms weighing twenty and three, and of sodium metal so light and free, that united with chlorine, of yellowish hue, to form common salt, a molecule new, that furnished the soda that, melted with sand, compounded the glass that lighted the window in the laboratory that Jack built.—*Chem. News.*

The Aeronautical Legacy.

A statement has been recently made in the papers that Charles F. Ritchel, of Bridgeport, Conn., had been made the legatee of a wealthy brewer, lately deceased, to enable him to extend his experiments in air navigation. So far as the legacy was made, the report was correct; but it is in such terms that it is doubtful that it can be legalized. Mr. Ritchel has not, as yet, received any portion of it, and he is not sanguine of obtaining a dollar from this source. The gentleman who thus showed, in his will, his interest in the experiments of Mr. Ritchel had, during his life, voluntarily aided him with funds to a small amount, but at present Mr. Ritchel's costs are borne by himself.

ENGINEERING INVENTIONS.

A car truck has been patented by Mr. Charles E. Candee, of New York city. In combination with the axles are oscillating boxes and screw cylinders of novel construction and arrangement, to facilitate the travel of cars upon curves, so they may be carried around short curves without excessive wear upon the wheels or rails.

Feeding air to locomotive furnaces forms the subject of a patent issued to Mr. James N. Weaver, of Sayre, Pa. The invention covers apparatus by which air heated by the escaping products of the furnace, or by the steam, is introduced over the fire, a steam blast being also used to quicken the draught and improve combustion.

A car truck has been patented by Mr. James N. Hicks, of Marysville, Pa. The invention relates to sliding bolsters for intermediate trucks, the truck having a perforation in the bolster and body, the car having a slot in the beam and means for forming a sliding joint with the bolster, and the king bolt having a squared portion to fit in the slot.

A gas regulator has been patented by Mr. Chester S. King, of Smethport, Pa. This invention covers the combination with a regulator of a separate diaphragm nearer the source of supply, with a novel construction for regulating the flow of gas as it comes in very irregular degrees of force from natural wells, where the pressure varies widely.

A double acting pump has been patented by Mr. James McGwin, of Fulton, Mo. It has an inner and an outer cylinder, the inner one with piston and piston rod packed in its top, and at the bottom of the cylinder are three tubes, each with a valve, one of the tubes communicating with the inner cylinder, another with the outer, and a third with a vertical channel between the two cylinders, the device being more especially designed for artesian wells.

MECHANICAL INVENTIONS.

A counter shaft has been patented by Mr. De Witt C. Cumings, of Carthage, Pa. The invention covers improvements, including an independent short shaft in line with the counter shaft, intended to secure a perfect and permanent alignment of the shaft in its bearings, to do away with the ordinary loose pulley, and to provide means for the better lubrication of the bearings.

A machine for dressing ship's sides has been patented by Mr. John Hamilton, of St. Johns, New Brunswick, Canada. It is a contrivance of machinery, whereby a rotary cutter or planer may be applied to and operated upon the sides of vessels, by a crank shaft to be operated by hand or by power, to dub and plane the sides better and faster than can ordinarily be done with hand tools.

A belt stretcher has been patented by Messrs. Garrison H. Jones, of Larwill, Ind., and James M. Chilcote, of Edgerton, Ohio. It is to take up the slack in belts without taking them from the pulleys, and covers a combination of head block with clamp, lugs with inclined planes, and wedges, the wedges being so introduced that the strain from the clamped ends tightens each wedge on the inclined planes, and the slack can be readily taken up.

A machine for forming scythes has been patented by Mr. Lucius C. Palmer, of Ballston Spa, N. Y. This invention combines, in a swaging machine, a reciprocating oscillating die with an adjustable bed die, with other improvements, for swaging scythe, corn knife, and other blades, in uniform shape from back to edge, and true taper from heel to point, making blades more uniform in thickness, and that will finish with less grinding, than those made by the hammering process.

AGRICULTURAL INVENTIONS.

A potato digger has been patented by Mr. Baltus Freeman, of Factoryville, Pa. Two carriage frames are hinged together, the forward one carrying radial rods operated from the drive wheels to loosen the earth, and the rear one having an adjustable frame with a screen, whereby the potatoes are raised from the ground, separated from the soil, and delivered into a basket or bag.

MISCELLANEOUS INVENTIONS.

A pump handle has been patented by Mr. James A. Craig, of Philadelphia, Pa. By this invention additional leverage is given, as compared with that of ordinary pumps, whereby water may be raised with facility from very deep wells.

A corpse head rest has been patented by Mr. John McGrath, of New York city. It consists of an elastic bar curved at its middle part, with a shorter one to fit the head and neck, the head rest being readily adjusted to hold without slipping.

An ironing table has been patented by Mr. Joseph H. Ritter, of Philadelphia, Pa. This is a novel design of folding table, so constructed that it can be compactly folded for storage and transportation, and which when arranged for use will be firm and stable.

A siphon starter has been patented by Mr. Eugene L. Fitch, of Des Moines, Iowa. This invention covers a special device for grasping and compressing the siphon tube, that can be so worked as to expel the air therefrom, and thus draw the siphon into action.

A fire escape has been patented by Mr. James Taylor, of New York city. It is intended more especially to improve appliances in connection with balcony fire escapes, and provides means whereby the ladders connecting the balconies can be more readily raised and lowered.

A handle for cross cut saws has been patented by Mr. Andrew Uren, of Seattle, Washington Ter. A single end handle is combined with an upright handle, both held firmly by one piece, and there is a rubber buffer or cushion to prevent damage to the saw or handle.

A axle bevel has been patented by Mr. Francis W. Flynn, of Woodstock, Conn. This is a convenient and accurate instrument of novel construction for setting and truing axles, giving the required set and gather, according to the diameter and dish of the wheel.

A vehicle axle cutter has been patented by Mr. Austin N. Ruiter, of Abercorn, Quebec, Canada. This invention covers a machine which, instead of revolving about the axle, is secured thereon, and combines in one instrument an axle cutter and a thread cutter, to cut either a right or left hand thread.

A door securer has been patented by Mr. Edward P. Conner, of Santa Rosa, Cal. It is a combined door lock and tool, with a flange which can be forced into the rabbet of a door, and the hammer head turned to act as a bolt, and can be used likewise as a screw driver and for drawing tacks.

A plaque and panel has been patented by Mr. Louis A. De Planque, of Jersey City, N. J. It is made of leather board shaped and provided with a coating of glue and whiting, and then having one or more coats of paint, being made very easily, taking a good finish, and not being expensive.

A nail holding attachment for hammers has been patented by Mr. George F. Barber, of De Kalb, Ill. It consists of a convenient appendage to hand hammers for holding and starting nails when only one hand can be used, or, where the work is out of reach by the hand, to hold the nail at starting.

A type writing machine has been patented by Mr. Darien W. Dodson, of Town Line, Pa. The invention covers a novel construction and arrangement of a machine that is very compact, can write rapidly, in which the keys are but slightly depressed, and which exhibits the whole sheet as fast as written.

A wrought iron fence post has been patented by Mr. Jacob G. German, of St. Mary's, Ontario, Canada. A vertical rod forms the post, having feet and notches to receive fence wires and lateral braces with eyes to receive the rod, all of novel design, and the posts and braces being so made that they can be anchored by placing stones on their feet.

A process for washing and purifying salt has been patented by Mr. Samuel S. Garrigues, of Ann Arbor, Mich. The salt is first placed in storage bins with perforated bottoms, then washed with a solution of three parts water to one of pure salt, the solution percolating through the salt and the perforated bottoms.

A drip pan for sewing machines has been patented by Mr. William Connolly, of South Norwalk, Conn. It is intended to save the oil dropping from the working parts of a machine, and has an inclined bottom with a strainer and discharge neck, on which a cup may be fixed in which the dripping oil will be collected.

A vehicle wheel has been patented by Mr. James J. Bush, of Tacoma, Washington Ter. This invention covers improvements on a former patented invention of the same patentee, providing increased facility for adjusting the wheel to its tire from time to time, or for putting on a tire or replacing the spokes of a wheel when necessary.

A combined wheelbarrow and sled has been patented by Mr. Franklin B. Kendall, of Tumwater, Washington Ter. The sides of the barrow are constructed to run either end first when the vehicle is converted into a sled, and it is provided with metal shoes or runners, in combination with a removable wheel and detachable legs.

A harness buckle has been patented by Mr. James A. Gavitt, of Walla Walla, Washington Ter. The invention consists of a peculiar construction of the buckle frame and the means for connecting it to the hame tugs, making a strong connection while affording great facility for connecting and disconnecting the same.

An ore sampling machine has been patented by Mr. Thomas T. Eyre, of Decatur, Col. It consists of a hopper or receptacle with a hole in the bottom for the ore to discharge from, means for stirring the ore, and for dividing it while running, so that ores, earths, chemicals, seeds, etc., may be divided into equal parts quickly and automatically.

A type writing machine has been patented by Messrs. George H. Herrington and David G. Millison, of Wichita, Kansas. It is a simple and inexpensive machine for printing words and sentences for the amusement and instruction of children, and so simple that a child can easily use it to acquire a knowledge of spelling, composing, and punctuating.

A sardine can has been patented by Mr. Julius Wolff, of New York city. Its top or bottom, or both, are made concave, and secured within the body of the can, so the operations of punching to allow the air to escape, and then closing the punctures, are avoided, and the improved cans serve as a test to show whether the soldering has been properly done.

An album satchel has been patented by Mr. Louis Lazarus, of Allegheny, Pa. The invention has for its object to provide a convenient receptacle for carrying articles of convenience for travelers, three or more boxes being provided with partitions, each having two or more hinges, hooks, pins, elastic straps, etc., all combined in the form of a substantial satchel.

A skid holder has been patented by Mr. John D. Coppes, of Nappanee, Ind. It is a device for holding skids on wagon wheels in loading wagons with logs, and is adapted to be hung on the end of a bolster supported on a wheel; it has projections between which the end of the skid is to be placed to prevent it from slipping off the wheel.

A self-adjusting match box holder has been patented by Mr. Henry W. Beeuwkes, Jr., of Paterson, N.J. The holder is a saucer shaped dish, in which the match box is so held that the matches can be readily taken out, and the empty box readily detached and replaced with a full one, the bottom of the dish forming a receptacle for burned matches and cigar ends.

A jacketed oleomargarine churn has been patented by Mr. Samuel Schwarzschild, of New York city. Its construction is such that the oils can be melted by steam or hot water admitted to the jacket, and will then be finely divided and mingled with each other and with milk or cream by the revolution of screens, the said substances being caused to pass through the meshes of the screens.

A feathering paddle wheel has been patented by Mr. Michael H. Depue, of Homer, Ill. The invention covers a novel construction designed to give the desired direction to the planes of paddles at all points of the revolution, and is intended primarily as a propeller for a flying machine, although the same principle may be adopted for boat propulsion, windmills, and current water wheels.

A faucet has been patented by Mr. Frank McCabe, of Providence, R. I. The object of the invention is to swivel the screw spindle operating the valve to a ring or washer between the screw cap and a shoulder of the tube in which the spindle works, thus increasing the durability of the packing, and subjecting it to less wear than when the packing is attached to the rotating spindle.

The manufacture of enameled brick forms the subject of a patent issued to Mr. Charles Newton, of Council Bluffs, Iowa. The invention covers a novel process of making front brick by pressing on or into the surface of ordinary front brick Portland or hydraulic cement of any suitable description, and of different colors, and hardening the same over streams of carbonic acid gas.

A key board attachment for musical instruments has been patented by Mr Edward F. O'Neill, of Storm Lake, Iowa. This invention is an improvement on a former patent issued to the same patentee, and consists in the combination, with a series of false keys hinged to a strip, of a frame adapted to rest on the strip and the front of the instrument, carrying rollers over which an endless music band passes in such manner as to depress the keys and make the desired melody.

A two wheeled vehicle has been patented by Mr. John C. Bach, of Hillsdale, Mich. This invention relates to carts in which the forward part of the body is suspended by a single spring from the front cross bar, and the spring is clipped loosely to the body at the bow, and extended therefrom a suitable distance downward and forward to a stud bolt projecting from the bottom of the body through an eye in the end of he spring.

NEW BOOKS AND PUBLICATIONS.

THE ENGLISH ILLUSTRATED MAGAZINE. Macmillan & Co., New York. Price 15 cents a number. June issue ready.

CASSELL'S FAMILY MAGAZINE. Cassell & Co., 739 Broadway, New York. June number published. $1.50 year. A single number 15 cents.

Special.

CONVENTION FOR THE PROTECTION OF INVENTORS.

The most ancient and respectable Patent Office in France, that of M. Maurice Sautter, of Paris, has just issued a circular giving interesting information concerning the International Convention for Protection of Industrial Property as agreed upon between eleven States and assented to by Great Britain, which is about being put in force. The great advantages offered thereby to foreign inventors belonging to the States of the Union are such as to make it worthy the U. S. Government to inform quickly as to advisability of joining the Union. We notice chiefly, as far as French patents are concerned, the two following points:

"Inventors are all aware of the extreme rigor of the French law, when defining (Art. 31) the novelty required to render an invention patentable in France. The effect of the actual legislation is that the mere fact of the description of the invention being open to public inspection in any part of the world, at any time anterior to the lodging of the French application, imperils the French patent.

"Article 4 of the Convention determines, on this point, that an inventor, who has protected his invention in one of the States of the Union, is allowed a period of six months, extended to seven for beyond-sea States, for procuring protection in the other States of the Union, without injury to said protections from intervening applications, exploitation, or publication by third parties."

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) F. B. J. asks: 1. Is it usual for steamships or large screw wheel tow boats with compound engines to have a cut-off on the low pressure cylinder? A. A cut-off on low pressure cylinder is quite common on large ocean going screw steamers, but not on tug boats. 2. With a compound engine do you consider it practical to use a large steam chest on the low pressure

cylinder, with a cut-off arranged in such a manner that the steam chest will act as a reservoir for the surplus steam, and no steam to pass into the condenser, except as it goes through the low pressure cylinder? A. Yes.

(2) W. W. W. asks: Is it not dangerous to have a copper lightning rod run on the ridge of a shingle roof? Should it not be supported by insulators? Brick, slate, etc., are almost insulators, are they not? A. The rod should run in contact with the building. Insulators should not be used. Compared with metal, dry brick and slate are poor conductors of electricity.

(3) A. F. O. wishes a translation of the following prescription: R. Hydrarg. ammon., gr. xx., Hydrarg. chlor. mitis, gr. xi., Petrolati, ℥ j. A. Take of white precipitate 20 grains, of calomel 11 grains, of petrolatum 1 ounce.

(4) S. E. S. writes: I am in quest of some substance that will produce a moderate degree of cold; preferably something that will retain its crystalline form above 32° Fah. In looking through my back numbers of SCIENTIFIC AMERICAN, I find on page 35, issue of July 17, 1880, a crystal ice prepared by Dr. Calantarients. Can you give me the exact ingredients, and proportions, in its composition? A. We cannot give you the exact proportions used in Dr. Calantarients' process, but the following table may be of interest. The water should not be warmer than 50° Fah.

Mixtures.		Degree of cold produced.
Ammonium nitrate	1 part	46°
Water	1 "	
Ammonium chloride	5 "	40°
Potassium nitrate	5 "	
Water	16 "	
Ammonium chloride	5 "	46°
Potassium nitrate	5 "	
Sodium sulphate	8 "	
Water	16 "	
Sodium sulphate	3 "	58°
Dilute nitric acid	2 "	
Ammonium nitrate	1 "	57°
Sodium carbonate	1 "	
Water	1 "	
Sodium phosphate	9 "	62°
Dilute nitric acid	4 "	
Sodium sulphate	8 "	50°
Hydrochloric acid	5 "	
Sodium sulphate	5 "	47°
Dilute sulphuric acid	4 "	
Sodium sulphate	6 "	60°
Ammonium chloride	4 "	
Potassium nitrate	2 "	
Dilute nitric acid	4 "	
Sodium sulphate	6 "	64°
Ammonium nitrate	5 "	
Diluted nitric acid	4 "	

(5) J. D. asks for the receipt for black bronze or dip on brass like sample sent, so it will fully cover all black, without showing the brass, and so it will remain on permanently, without rubbing off while handling. A. The black on the sample appears to be the result of dipping the wire into a solution of silver nitrate, then heating until it blackens, when the wire is dipped into lard oil and the excess of black rubbed off with a piece of cotton waste. It is not a permanent coat, however, but as much so as is possible to obtain.

(6) J. S. asks how to get rid of his neighbor's pigeons, which destroy all his flowers and plants, and are a pest to the whole neighborhood. A. There are several legitimate ways of getting rid of your neighbor's pigeons. Buy him out, sell out yourself, remove, or have the pigeons indicted by the grand jury as a nuisance.

(7) P. M. B. asks: Can anything be done to save large shade trees which have been almost destroyed by the surrounding earth having been impregnated with escaped gas (made from petroleum) from the city main? A. We know of nothing that will avail in such case. Preventing the leakage, if possible, opening up the ground, and substituting new earth to some extent might be advantageous if the trees are not yet too much injured.

(8) A. N. asks: Please tell me the proper pickle to clean sheet iron for tinning or galvanizing. Have tried oil of vitriol, which dissolves the iron and not the scale. The addition of salt is no benefit. Muriatic acid and water is better, but too expensive. A. Use the muriatic acid of commerce with water in the proportions by quantity of 5 of acid and 3 of water. Heat the plate and immerse it, while hot, in the solution. An immersion of a few second sis sufficient.

(9) E. S. asks: Will you kindly refer me to an establishment where I can learn pattern making? A. You may learn pattern making best in a large machine shop in Detroit or Chicago. The trade is also carried on independently. If you are a good carpenter or cabinet maker, you can more readily learn to make patterns. If you know nothing of these trades, we recommend you to start with a cabinet maker in your own neighborhood and learn to use tools first.

(10) E. T. T. asks: What is the geometric center of a triangle? A. The geometrical center of a triangle is the assumed center of gravity for its surface, and may be found by bisecting the sides and drawing a line from the points of bisection to their opposite angles. The point of meeting of these lines is the geometric center.

(11) J. B. Q. asks: 1. What is the variation of the magnetic needle at the fourth meridian east from Washington? A. The variation of the compass for Addison Co. is 12° 38′′ west for this year, with an increase of 8 minutes for each subsequent year for a few years. 2. How are the compasses arranged on iron ships so as not to be affected by the iron? A. By the use of a disk of soft iron under or near the compasses, which neutralizes the effect of the local attraction upon the needle. It is called a "compensator." 3. Why does the magnetic pole move around the earth, and how long does it take to make a revolution? A. This has never been determined. The secular variation of the needle in the eastern part of the United States seems to have a period of about one hundred years, in which the variation attains a maximum and minimum. This indicates a local circuit of 400 years, or if the motion is in a great circle with two poles, which is strongly indicated, the revolution of each magnetic pole in the great circle is probably about 800 years.

(12) J. E. W. asks if any substitute can be used in the place of arsenic for the manufacture of Turkey red, or is there arsenic in all reds used for wall paper? A. Turkey red is now principally produced by alizarine or madder, neither of which contains arsenic.

(13) F. I. P. writes: In your issue of April 26, you give a formula to prepare writing paper so that it will be waterproof and greaseproof. I have tried to prepare tissue paper by that formula, and after immersing it have hung it up to dry, and find the solution runs entirely (or most so) out of the paper, leaving it in the same condition as it was first. Can you give me any suggestion as to how to overcome this? Also, I wish to prepare a gold lacquer, tough enough to stand stamping, the same as used on the tin foil of champagne bottles. A. Perhaps the following will produce better results: Dissolve 8 ounces of alum and 3¾ ounces of Castile soap in 4 pints of water, and 2 ounces of gum arabic and 4 ounces of glue separately in 4 pints of water. Mix the solutions, heat slightly, dip in single sheets, which hang up until dry. Dip several times if necessary. For a pale gold lacquer the following is good: 1 gallon methylated spirits of wine, 10 ounces of seed lac bruised, and half an ounce red sanders; dissolve and strain.

(14) C. N. asks for a formula for a walnut stain on poplar wood that will not raise the grain. A. Take 1 quart water, 1½ ounces washing soda, 2½ ounces Vandyke brown, ¼ ounce potassium bichromate. Boil for ten minutes and apply with a brush either in hot or cold state, or try this: spirits of turpentine 1 gallon, pulverized asphaltum 2 pounds; dissolve in an iron kettle on a stove, stirring continually. Can be used over a red stain to imitate rose wood. To make a perfect black add a little lamp black. The addition of a little varnish with the turpentine improves it.

(15) A. K. M.—We would advise you to try the use of potassium salts, either the sulphate or the chloride (muriate), with the fertilizers which you already employ.

(16) W. P. R. and C. I. B. ask how billiard cue tips are made, the kind of leather, and how prepared to give the required softness when ready for use. A. See SCIENTIFIC AMERICAN, April 26, 1884, for new way of fixing billiard cue tips. The leathers are cut by a sharp rimming tool running in a lathe, much the same as buttons are cut; hard leather is never used therefor, only the parts of the belly and shoulders of sole leather which are thick, soft, and spongy.

(17) M. F. S. asks for a receipt for making ribbon ink, such as is used on the type writers. A.

Use Aniline black	½ ounce.
Pure alcohol	15 "
Concentrated glycerine	15 "

Dissolve the aniline black in the alcohol, and add the glycerine.

(18) A. L. D. asks how long a strip of carpet can be laid in a room 40 feet long by 15 feet wide. The carpet to be one yard wide. A. If you refer to amount of carpet required, and if the carpet is of the kind called return match, it will take 60⅔ yards. If regular match, it will take 70⅓ yards. A diagonal across the room would measure about 42 feet 4 inches.

(19) I. N. K. asks: 1. How many pounds of coal are required to convert fifty pounds of water into steam? A. With good arrangement of boiler, one pound of coal should convert 8 or 9 pounds of water to steam. It will take therefore between 6 and 7 pounds of coal to convert 50 pounds of water. 2. And how many pounds will it raise one foot high in one minute? A. Under ordinary circumstances 4 pounds of coal are consumed to produce one horse power per hour. One horse power is equal to 33,000 pounds raised one foot in one minute, and 1½ horse (=6 pounds of coal) equal 49,500 foot pounds.

(20) R. H. B. asks: 1. How much hydrated oxide of magnesia should be used to a barrel of hard well water to soften it? A. The exact quantity of the magnesium salt naturally depends upon the degree of softness or hardness of your water. The quantity to be used would only be slight at best. 2. What proportion of powdered oxide of magnesia, sawdust, and water would give the best results for filtering? A. Use 5 per cent of the finely powdered magnesium oxide. 3. To what degree does it have to be heated to form hydrated oxide of magnesia? A. The degree of heat is immaterial; heat it as high as you please, but not lower than 212° Fah. 4. What quantity would be necessary for a filter for family use to soften ordinary hard well water by passing once through the filter? A. Use the same proportions as recommended above; it will require changing from time to time.

(21) L. F., Jr., asks how to make Cognac oil and bead oil, such as wholesale liquor dealers use. A. Oil of cognac is prepared by dissolving the fusel oil of brandy marc in strong rectified spirit, and then adding a sufficient quantity of concentrated sulphuric acid to form a sulphate; alcohol and excess of acid are removed by washing the newly formed compound with water. To 100 pounds marc add half a pound sulphuric acid; the oil is generally formed toward the end of the distillation, and is found floating in blackish drops on the surface of the distillate. According to a distinguished French chemist, this oil is a compound of potato oil and œnanthic ether. Bead oil is a compound that we are not familiar with.

(22) G. B. asks: How is silk dissolved, so that it can be used as a solution by the process of Mueller, invented in Germany some years ago? A. Silk is soluble in the basic chloride of zinc, and also preparations in which it is soluble are given on page 1083 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 68, and also on page 1229, SCIENTIFIC AMERICAN SUPPLEMENT, No. 77. We have at hand no information concerning Mueller's process.

(23) C. W. H. asks how to remove aniline red dye from the hands. He says: I have been accustomed to the use of such dyes for some years, but have never been able to find anything that would accomplish such purpose. I find, however, by the use of a certain compound of an alkali nature, that the color can be removed almost instantaneously from the hands by its application; but what to me is a strange phenomenon that upon washing the hands in cold water in order to remove the alkali, the red color is again restored. I am very desirous of learning why a color which to all appearances has been faded out, or destroyed, can again be entirely restored by the application of some other ingredients differing entirely from the original color in its nature. A. Colored substances consist of two elements, the chromogen and the chromopher; by the addition of an alkali the former, which is acid, is neutralized, so that the coloring becomes invisible, while when water is added its acid properties restore the coloring.

(24) G. W. asks for recipe for staining new mahogany a deep rich red without hiding the grain; also the best polishing material—and how to apply it—after the furniture is so stained. If a filler should be used, please give recipe. A. The following is used when furniture is repaired, and the old wood cannot be matched, so that the work presents a patched appearance. The pieces are washed with soap lees, or dissolve quick lime in water and use in the same manner; but be careful not to let either be too strong, or it will make the wood too dark; it is best therefore to use it rather weak at first, and, if not dark enough, repeat the process till the wood is sufficiently darkened.

(25) B. S. H. asks: 1. Is there any ink which is black at the time of writing and which will gradually disappear? If so, how made, and how may it be made to appear again? A. Boil nut galls in aqua vitæ; put some Roman vitriol and sal ammoniac to it, and when cold dissolve a little gum arabic, and it will, when written with, vanish in twenty-four hours. We do not think that it can be made to reappear. 2. Is there any simple method of making the carbonate of sodium from the chloride? A. Sodium chloride is a natural product, and is the basis for the manufacture of sodium carbonate, and therefore there is no simple method for the process asked for. The addition of carbonate of silver would probably bring about the desired result. 3. How may stove polish be taken off nickel plate so as to leave the surface bright? A. Remove the stove polish with warm soap suds. 4. How is the appearance of lightning produced in a theater? A. Lightning may be produced in theaters by means of lycopodium. A quantity of it is thrown from a bellows across some suitable flame.

(26) I. L. S. writes: 1. A steam pump working underground at a depth of 200 feet, forcing a column of water to surface filling a 2½ inch pipe: Is there more or less strain on pump, if forcing same amount of water through a 12 inch column pipe? A. The strain on the pump will be rather less with the large pipe, from reduced friction of the water on its sides. 2. A steam gauge registering 80 pounds, another 75 pounds, on same boiler, which is right? A. The only way to ascertain which is wrong is by testing them by a test gauge or column.

(27) S. T. H. asks (1) receipts for making red and green fire, such as used for tableau lights. A. For red lights, use a mixture of 84 parts potassium chlorate, 80 parts strontium nitrate, 51 parts calomel, 22 parts dextrine, 18 parts shellac, 4 parts Chester's copper. Green lights consist of:

Barium nitrate	80 parts.
Potassium chlorate	32 "
Sulphur	24 "
Calomel	16 "
Fine charcoal	3 "
Shellac	2 "

2. Can you inform me how many strings there are on a mandoline, and if they are played anything like a guitar? A. It is an instrument of the guitar kind, and there are several varieties, each with different tunings. The Neapolitan has four strings, tuned like those of the violin—G, D, A, E. The Milanese has five double strings, each pair in unison, tuned G, C, A, D, E.

(28) C. C. We think this will serve for the "silver cream" process you desire: Clean the copper plate, and rub it with a clean rag and a little of Levi's creme d'argent—cyanide of silver. Remove the superfluous cream with a clean rag, and the plate will be properly silvered.

(29) J. R. asks: 1. What paper is used in making paper boats? A. The paper is made specially for the purpose, in narrow rolls of varying thickness up to that of a thick cardboard, of flax, hemp, or wood fiber, according to the quality sought; it is laid in successive strips, over a former, with glue or paste. 2. How is papier mache rendered waterproof? A. The waterproofing is generally shellac or a varnish. 3. How are leaves bleached, such as ferns and oak? We have taken the SCIENTIFIC AMERICAN for ten years, and have not troubled you before. A. Leaves are bleached with a solution of chloride of lime and water, about one tablespoonful to a quart of water. Add a few drops of vinegar; subject for ten to twenty minutes, then rinse in clean water, and dry between blotting paper.

(30) H. D. writes: Will you please give length, diameter, thickness of plates, etc., for an upright tubular boiler 30 horse power, to be worked up to a pressure of 100 pounds to the square inch. A. Your boiler may be given the following dimensions: diameter, 48 inches; height, 9¾ feet; diameter of furnace, 43 inches; height of furnace, 33 inches; length of tubes, 84 inches; number of tubes, 2 inches in diameter, 120; thickness, five-sixteenths of an inch good iron to stand that pressure.

(31) J. J. W. asks: What height and width inside should a brick chimney be made, to give sufficient draught to burn tan bark after being bleached and not dried? Length of boiler being 14 feet over all, tubes 12 feet long, 36 in number, 2¼ inches diameter. Furnace being double, *i. e.*, double the size of an ordinary one. Have you any idea as to what number of bricks it would require to build same? A. About 60 feet high, or perhaps more, according to location for draught, and about 2 feet square inside at bottom. Wet tan burning requires large furnace or oven capacity, and exceptionally good draught. Such chimney will probably take about 30,000 bricks.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

R. B. J.—No. 1 contains pyrite (iron sulphide) in hornblende, and is apparently of no value. No. 2 is a silicate mineral, and does not contain any metal; it is probably one of the varieties of hornblende.

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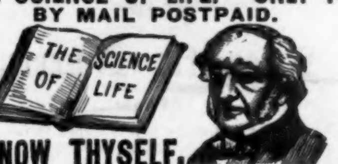

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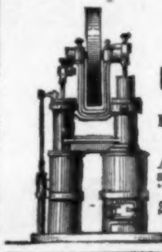

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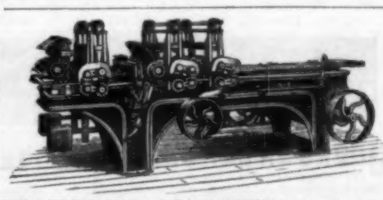

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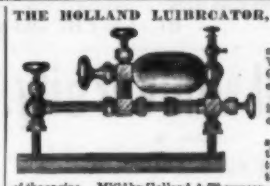

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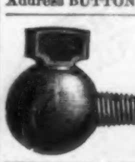

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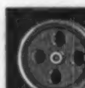

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